Chronic Kidney Disease

CKD: Major Recommendations (2010)

Recommendations are categorized in terms of either conditional or imperative statements. While conditional statements clearly define a specific situation, imperative statements are broadly applicable to the target population and do not impose restraints on their application.

Conditional recommendations are presented in an if/then format, such that:

> If CONDITION then ACTION(S) because REASON(S)

Fulfillment of the condition triggers one or more guideline-specified actions. In contrast, imperative recommendations include terms such as "require, " "must, " and "should, " and do not contain conditional text that would limit their applicability to specified circumstances.

Resources Available with Each Recommendation

In addition to the recommendation statement and strength rating, you will find on each recommendation page:

- A brief narrative summary of the evidence analyzed to reach the recommendation
- A statement of justification, or reason for the strength of the recommendation
- Detailed information on the evidence supporting the recommendations and background narrative (available in the Supporting Evidence section toward the bottom of each recommendation page)
- A reference list at the end of each recommendation page that includes all the sources used in the evidence analysis for the particular recommendation (each reference is hyperlinked to a summary of the article analyzed in the evidence analysis).

Below, you will find a list of the **Chronic Kidney Disease** Recommendations, organized according to the stage of the Nutrition Care Process and by topic. To see the Recommendation Summary, just click on the Recommendation title.

Also view the Executive Summary of Recommendations or print the guideline features under Print Reports.

CKD Recommendations:

Chronic Kidney Disease (CKD): Medical Nutrition Therapy (Non-Dialysis)

- CKD: Medical Nutrition Therapy
- CKD: Initiation of Medical Nutrition Therapy
- CKD: Frequency of Medical Nutrition Therapy

Assessment

Chronic Kidney Disease (CKD): Assessment of Food/Nutrition-Related History

- CKD: Initial Assessment of Food/Nutrition-Related History
- CKD: Reassessment of Food/Nutrition-Related History

Chronic Kidney Disease (CKD): Anthropometric Assessment Options

- CKD: Use Clinical Judgment in Assessing Body Weight
- CKD: Use Published Weight Norms with Caution
- CKD: Assessment of Body Composition
- CKD: Methodologies for Body Composition Assessment

Chronic Kidney Disease (CKD): Assessment of Biochemical Parameters

- CKD: Assess Biochemical Parameters

Chronic Kidney Disease (CKD): Assess CKD-Mineral and Bone Disorders

Chronic Kidney Disease (CKD): Assessment of Medical/Health History

Intervention

Chronic Kidney Disease (CKD): Protein Intake

- CKD: Protein Intake for eGFR
- CKD: Very Low Protein Intake for eGFR
- CKD: Protein Intake for Diabetic Nephropathy
- CKD: Protein Intake for Kidney Transplant

Chronic Kidney Disease (CKD): Energy Intake

Chronic Kidney Disease (CKD): Phosphorus

- CKD: Phosphorus
- CKD: Adjust Phosphate Binders
- CKD: Phosphorus Management for Kidney Transplant

Chronic Kidney Disease (CKD): Calcium

Chronic Kidney Disease (CKD): Vitamin D Therapy

- CKD: Vitamin D Supplementation

Chronic Kidney Disease (CKD): Anemia

- CKD: Iron Supplementation
- CKD: Vitamin B12 and Folic Acid for Anemia
- CKD: Vitamin C for Treatment of Anemia
- CKD: L-Carnitine for Treatment of Anemia

Chronic Kidney Disease (CKD): Management of Hyperglycemia in Diabetes and CKD

Chronic Kidney Disease (CKD): Multi-Faceted Approach to Intervention in Diabetes and CKD

Chronic Kidney Disease (CKD): Multi-Faceted Approach to Intervention in Dyslipidemias and CKD

Chronic Kidney Disease (CKD): Education on Self-Management Behaviors

Chronic Kidney Disease (CKD): Sodium

- CKD: Control Sodium Intake in CKD

Chronic Kidney Disease (CKD): Fish Oil/Omega-3 Fatty Acids

Chronic Kidney Disease (CKD):Physical Activity

Chronic Kidney Disease (CKD): Coordination of Care

Chronic Kidney Disease (CKD): Multivitamin Supplementation

Chronic Kidney Disease (CKD): Potassium

- CKD: Control Potassium Intake in CKD

Monitoring and Evaluation

Chronic Kidney Disease (CKD): Monitor and Evaluate Biochemical Parameters

Chronic Kidney Disease (CKD): Monitor and Evaluate Adherence to Nutrition and Lifestyle Recommendations

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Medical Nutrition Therapy (Non-Dialysis) 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Medical Nutrition Therapy

Medical nutrition therapy (MNT) provided by a registered dietitian (RD) is recommended for individuals with chronic kidney disease (CKD, Stages One to Five including post-kidney transplant). MNT prevents and treats protein-energy malnutrition and mineral and electrolyte disorders and minimizes the impact of other comorbidities on the progression of kidney disease (e.g., diabetes, obesity, hypertension and disorders of lipid metabolism). Studies regarding effectiveness of MNT report significant improvements in anthropometric and biochemical measurements sustained for at least one year.

Rating: Strong
Imperative

CKD: Initiation of Medical Nutrition Therapy

Referral for MNT per federal or state guidelines, should be initiated at diagnosis of CKD, in order to maintain adequate nutritional status, prevent disease progression and delay renal replacement therapy (RRT). MNT should be initiated at least 12 months prior to the anticipation of RRT (dialysis or transplant).

Rating: Strong
Imperative

CKD: Frequency of Medical Nutrition Therapy

Depending on the care setting and the initiation of MNT, the RD should monitor the nutritional status of individuals with CKD every one to three months and more frequently if there is inadequate nutrient intake, protein-energy malnutrition, mineral and electrolyte disorders or the presence of an illness that may worsen nutritional status, as these are predictive of increased mortality risk. Research related to the time requirements for MNT provided by an RD indicate that approximately two hours per month for up to one year may be required to provide an effective intervention for adults

with CKD.

Rating: Strong
Conditional

- Risks/Harms of Implementing This Recommendation

  None.

- Conditions of Application

  For the recommendation on *Frequency of Medical Nutrition Therapy,* frequency of care may depend on the care setting (i.e., acute care, long-term care, outpatient care, etc.).

  It should be noted that RDs with National Provider Identification (NPI) numbers in the Medicare system are specifically designated as qualified to provide MNT services to Medicare beneficiaries. At the time of guideline development in 2010, covered diagnoses include: Non-dialyzed CKD with renal function of 13ml to 50ml per minute per 1.73m², post-renal transplant up to three years and diabetes mellitus. Private third-party insurance carriers may or may not follow similar diagnostic guidelines for coverage. Some carriers may offer a limited number of RDs as "in-network" providers. The ADA CKD expert workgroup agrees that RD providers of MNT who have additional expertise in renal disease management may be preferred for persons with CKD. Patients may choose to engage an RD with renal experience by selecting a qualified "out-of-network" provider or by electing to receive MNT sessions on a self-pay basis.

- Potential Costs Associated with Application

  Although costs of MNT sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

  - Research related to the time requirements for MNT provided by an RD indicate that approximately two hours per month for up to one year may be required to provide an effective intervention for adults with CKD. Medical nutrition therapy should be initiated at least 12 months prior to the anticipation of renal replacement therapy (dialysis or transplant) (Dolecek et al, 1995; Milas et al, 1995; Moore et al, 2003).
  - Studies regarding effectiveness of MNT report significant improvements in anthropometric and biochemical measurements sustained greater than or equal to one year (Diabetes Control and Complications Trial [DCCT] Research Group, 1993; Delahanty, 1998; Pijls et al, 1999; Pijls et al, 2000; Cliffe et al, 2001; Chauveau et al, 2003; Prakash et al, 2004).

  Subsequent to the publication of the guideline reference below, terminology has been updated.

  From the KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure (2000)

  - *Guideline 26: Intensive Nutritional Counseling for Chronic Renal Failure (CRF)*
    - The nutritional status of individuals with CRF should be monitored at regular intervals (Evidence)
      - A spontaneous reduction in dietary protein intake (DPI) and a progressive decline in indices of nutritional status occur in many non-dialyzed patients with CRF
      - The presence of protein-energy malnutrition at the initiation of maintenance dialysis is predictive of future mortality risk
      - Interventions that maintain or improve nutritional status during progressive renal failure are likely to be associated with improved long-term survival after commencement of maintenance dialysis
      - Because evidence of protein-energy malnutrition may develop before individuals require renal replacement therapy, regular monitoring (e.g., at one- to three-month intervals) of the patient's nutritional status should be a routine component of the care for the patient with CRF
      - Nutritional status should be assessed more frequently if there is inadequate nutrient intake, frank protein-energy malnutrition or the presence of an illness that may worsen nutritional status.
    - *Appendix IV: Role of the Renal Dietitian*
      - Implicit in many of the guidelines in this document is the availability to the patient of an individual with expertise in renal dietetics
      - Implementation of many of the guidelines concerning nutritional assessment (anthropometry, subjective global assessment, dietary interviews and diaries and integration of the results of nutritional measurements) and nutritional therapy (developing a plan for nutritional management, counseling the patient and his or her family on appropriate dietary protein and energy intake, monitoring nutrient intake, educational activities and encouragement to maximize dietary compliance) is best performed by an individual who is trained and experienced in these tasks
      - Although occasionally a physician, nurse or another individual may possess the expertise and time to conduct such activities, a registered dietitian, trained and experienced in renal nutrition, usually is best qualified to carry out these tasks.

- Recommendation Strength Rationale

  - Conclusion statement received Grade I
  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure. KDOQI group members accepted the guideline statements as valid if the median panel rating was seven or greater on a scale of one to nine.
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes

(KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines.
Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  Is MNT provided by a Registered Dietitian for chronic kidney disease (CKD) in adults effective?

  - References

    Chauveau P, Vendrely B, Haggan E W, Barthe N, Rigalleau V, Combe C, Aparicio M. Body composition of patients on a very-low-protein diet: A two-year survey with DEXA. J.Ren. Nutr. 2003; 13 (4): 282-287.

    Cliffe M, Bloodworth LLO, Jibani MM. Can malnutrition in predialysis patients be prevented by dietetic intervention? J Renal Nutr. 2001; 11: 161-165.

    The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med* 1993; 329:977-986.

    Delahanty LM. Implications of the diabetes control and complications trial for renal outcomes and medical nutrition therapy. *J Renal Nutr*. 1998; 8: 59-63.

    Dolecek TA, Olson MB, Caggiula AW, Dwyer JT, Milas NC, Gillis BP, Hartman JA, DiChiro JT. Registered dietitian time requirements in the Modification of Diet in Renal Disease Study. J Am Diet Assoc. 1995;95:1307-1312.

    Milas NC, Nowalk MP, Akpele L, Castaldo L, Coyne T, Doroshenko L, Kigawa L, Korzec-Ramirez D, Scherch LK, Snetselaar L. Factors associated with adherence to the dietary protein intervention in the Modification of Diet in Renal Disease Study. *J Am Diet Assoc*. 1995; 95:1295-1300.

    Moore H, Reams SM, Wiesen K, Nolph KD, Khanna R, Laothong C, National Kidney Foundation Council on Renal Nutrition. National Kidney Foundation Council on Renal Nutrition Survey: Past-present clinical practices and future strategic planning. *J Ren Nutr*. 2003; 13(3): 233-240.

    Pijls LTJ, de Vries H, Donker AJM, van Eijk JTM. The effect of protein restriction on albuminuria in patients with type 2 diabetes mellitus: a randomized trial. *Nephrol Dial Transplant*. 1999; 14: 1445-1453.

    Pijls LTJ, de Vries H, van Eijk JThM, Donker AJM. Adherence to protein restriction in patients with type 2 diabetes mellitus: a randomized trial. *Eur J Clin Nutr*. 2000; 54:347-352.

    Prakash S, Pande DP, Sharma S, Sharma D, Bal CS, Kulkarni H. Randomized, double-blind, placebo-controlled trial to evaluate efficacy of ketodiet in predialytic chronic renal failure. *J Renal Nutr*. 2004; 14: 89-96.

    Wardak J, Glabska D, Narojek L, Rojek-Trebicka J. Analysis of the intake of protein and energy by predialysis patients with chronic renal failure receiving essential amino acid ketoanalogues. *Rocz Panstw Zakl Hig*. 2007; 58(1): 153-158.

  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
    - *Guideline 26:* Intensive Nutritional Counseling for Chronic Renal Failure (CRF): http://www.kidney.org/Professionals/kdoqi/guidelines_updates/nut_a26.html
    - *Appendix IV:* Role of the Renal Dietitian: http://www.kidney.org/Professionals/kdoqi/guidelines_updates/nut_appx04a.html.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Assessment of Food/Nutrition-Related History 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Initial Assessment of Food/Nutrition-Related History

  The registered dietitian (RD) should assess the food- and nutrition-related history of adults with chronic kidney disease (CKD, including post kidney transplant), including but not limited to the following:

- Food and nutrient intake [e.g., diet history, diet experience and intake of macronutrients (and micronutrients, such as energy, protein, sodium, potassium, calcium, phosphorus, and others), as appropriate]
- Medication (prescription and over-the-counter), dietary supplements (vitamin, minerals, protein, etc.), herbal or botanical supplement use
- Knowledge, beliefs or attitudes (e.g., readiness to change nutrition and lifestyle behaviors)
- Behavior
- Factors affecting access to food and food and nutrition-related supplies (e.g., safe food and meal availability).

Assessment of the above factors is needed to effectively determine nutrition diagnoses and plan the nutrition interventions. Inability to achieve optimal nutrient intake may contribute to poor outcomes.

Rating: Consensus
Imperative

CKD: Reassessment of Food/Nutrition-Related History

On subsequent visits, the RD should reassess the food- or nutrition-related history of adults with CKD (including post kidney transplant), related to changes in other assessment parameters (laboratory and anthropometric changes), including but not limited to the following:

- Food and nutrient intake, targeted to changes in biochemical parameters
- Medication, dietary supplements, herbal or botanical supplement use
- Knowledge, beliefs or attitudes
- Behavior
- Factors affecting access to food and food and nutrition-related supplies.

Assessment of the above factors is needed to explain changes in the other assessment parameters and plan additional nutrition interventions. Inability to achieve optimal nutrient intake may contribute to poor outcomes.

Rating: Consensus
Imperative

- Risks/Harms of Implementing This Recommendation

  None.

- Conditions of Application

  No conditions specified.

- Potential Costs Associated with Application

  Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

  Subsequent to the publication of the guideline referenced below, terminology has been updated.

  From the KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure (2000)

  Guideline 23: Panels of Nutrition Measures for Non-Dialyzed Patients

  - For individuals with CRF (GFR less than 20ml per minute) protein-energy nutritional status should be evaluated by serial measurements of a panel of markers including at least one value from each of the following clusters:
    1. Serum albumin
    2. Edema-free actual body weight, percentage standard (NHANES II) body weight or subjective global assessment (SGA)
    3. Normalized protein nitrogen appearance (nPNA) or dietary interviews and diaries (evidence and opinion).

  Appendix III: Dietary Interviews and Diaries

  - There are several methods for estimating dietary nutrient intake. The most common methods are food intake records and dietary recalls. The dietary recall (usually obtained for the previous 24 hours) is a simple, rapid method of obtaining a crude assessment of dietary intake. It can be performed in approximately 30 minutes, does not require the patient to keep records and relies on the patient's ability to remember how much food was eaten during the previous 24 hours. Accurate quantification of the amounts of foods eaten is critical for the 24-hour recall. Various models of foods and measuring devices are used to estimate portion sizes. Advantages to the recall method are that respondents usually will not be able to modify their eating behavior in anticipation of a dietary evaluation and they do not have to be literate. Disadvantages of the 24-hour recall include its reliance on memory (which may be particularly limiting in the elderly), that the responses may be less accurate or unrepresentative of typical intakes and that it must be obtained by a trained and skilled dietitian.
  - Dietary diaries are written reports of foods eaten during a specified length of time. A food-intake record, lasting for several (three to seven) days, provides a more reliable estimate of an individual's nutrient intake than do single-day records. Records kept for more than three days increase the likelihood of inaccurate reporting because an individual's motivation has been shown to decrease with an increasing number of days of dietary data collection, especially if the days are consecutive. On the other hand, records maintained for shorter times may not provide accurate data on usual food and nutrient intakes. The actual number of days chosen to collect food records should depend on the degree of accuracy needed, the day-to-day variability in the intake of the nutrient being measured and the cooperation of the patient.
  - The validity and reliability of the dietary interviews and diaries depend on the patient's ability to provide accurate data and the ability of the nutritionist to conduct detailed, probing interviews. The intake of nutrients is generally calculated using computer-based programs. Food records must be maintained

meticulously to maximize the accuracy of the diary. Food intake should be recorded at the time the food is eaten, to minimize reliance on memory. Special data collection forms and instructions are provided to assist the individual to record adequate detail. Recording error can be minimized if instructions and proper directions on how to approximate portion sizes and servings of fluid are provided.
- Food models are also helpful for instruction. The food record should indicate the time of day of any intake (both meals and snacks), the names of foods eaten, the approximate amount ingested, the method of preparation and special recipes or steps taken in the food preparation. The dietitian should carefully review the food record with the patient for accuracy and completeness shortly after it is completed.

- Recommendation Strength Rationale

  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
  - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  - References
  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
    - *Guideline 23: Panels of Nutrition Measures for Non-Dialyzed Patients:* http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_a23.html
    - *Appendix III: Dietary Interviews and Diaries:* http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_appx03a.html.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Anthropometric Assessment Options 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Use Clinical Judgment in Assessing Body Weight

  Due to the absence of standard reference norms in the chronic kidney disease population (CKD, including post kidney transplant), the registered dietitian (RD) should use clinical judgment to determine which data to include in estimations of body weight:

  - Actual measured weight
  - History of weight changes (both long-term and recent)
  - Serial weight measurements, monitored longitudinally
  - Adjustments for suspected impact of edema, ascites and polycystic organs.

  Body weight estimates are used for calculation of nutritional needs, such as protein and energy requirements. Body weight can be difficult to determine because as kidney function declines, the ability to regulate fluid balance may be compromised and multiple factors must be considered.

  Rating: Consensus
  Imperative

  CKD: Use Published Weight Norms with Caution

The RD may use other published weight norms in the anthropometric assessment of individuals with CKD (including post kidney transplant), but each norm has significant drawbacks and must be used with caution:

- Ideal body weight (IBW) is the body weight associated with the lowest mortality for a given height, age, sex and frame size and is based on the Metropolitan Life Insurance Height and Weight Tables. *[Caution: Not generalizable to the CKD population and data-gathering methods were not standardized.]*
- Hamwi Method determines the optimal body weight. *[Caution: A quick and easy method for determining optimal body weight, but has no scientific data to support its use.]*
- Standard Body Weight, NHANES II (SBW as per KDOQI Nutrition Practice Guidelines) describes the median body weight of average Americans from 1976 to 1980 for height, age, sex and frame size. *[Caution: Although data is validated and standardized and uses a large database of ethnically-diverse groups, data is provided only on what individuals weigh, not what they should weigh in order to reduce morbidity and mortality.]*
- Body Mass Index (BMI) often defines generalized obesity and CKD research, specific to dialysis patients, has identified that patients at higher BMIs have a lower mortality risk. *[Caution: The researchers may not have statistically adjusted for all confounders related to comorbid conditions occurring in CKD on dialysis (diabetes, malignancy, etc) and it is unclear how it may relate to CKD patients not on dialysis.]*
- Adjusted Body Weight (ABW) is based on the theory that 25% of the excess body weight (adipose tissue) in obese patients is metabolically active tissue. KDOQI supports the concept of subtracting 25% for obese patients and adding 25% for underweight patients. *[Caution: This has not been validated for use in CKD and may either overestimate or underestimate energy and protein requirements.]*

Body weight estimates are used for calculation of nutritional needs, such as protein and energy requirements. Body weight can be difficult to determine because as kidney function declines, the ability to regulate fluid balance may be compromised and multiple factors must be considered.

Rating: Consensus
Conditional

CKD: Assessment of Body Composition

The RD should assess the body composition of individuals with CKD (including post kidney transplant). Studies suggest that CKD patients exhibit altered body composition, as compared to healthy individuals.

Rating: Fair
Imperative

CKD: Methodologies for Body Composition Assessment

When assessing the body composition of individuals with CKD (including post kidney transplant), the RD may use any valid measurement methodology, such as anthropometrics (including waist circumference and body mass index) and body compartment estimates. Currently, there is no reference standard for assessing body composition in CKD patients and studies do not show that any one test is superior to another in assessing body composition among CKD patients.

Rating: Fair
Imperative

- Risks/Harms of Implementing This Recommendation

  None.

- Conditions of Application

  - Certain recommendations apply to individuals with CKD who also have wasting syndrome, cachexia and are overweight or obese
  - Certain recommendations apply to RDs who are trained in subjective global assessment (SGA).

- Potential Costs Associated with Application

  Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

  - Methods used to assess body composition in CKD patients include anthropometric measures, DXA, BIA, creatinine kinetics (CK) and computed tomography (CT)
  - Anthropometry and DXA are the two most often used methods in research studies, but currently there is no reference standard for assessing body composition in CKD patients
  - Studies suggest that CKD patients exhibit altered body composition, as compared to healthy individuals (Woodrow et al, 1996; Heimburger et al, 2000; Avesani et al, 2004; Rigalleau et al, 2004; Bellizzi et al, 2006; Barreto et al, 2008; Sanches et al, 2008). These results do not show any one test is superior to another in assessing body composition among CKD patients.

  Subsequent to the publication of the guideline reference below, terminology has been updated.

  From the KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure (2000)

  - *Guideline 23:* Panels of Nutrition Measures for Non-Dialyzed Patients
    - For individuals with CRF (GFR under 20ml per minute), protein-energy nutritional status should be evaluated by serial measurements of a panel of markers, including at least one value from each of the following clusters
      1. Serum albumin
      2. Edema-free actual body weight, percentage standard (NHANES II) body weight or SGA
      3. Normalized protein nitrogen appearance (nPNA) or dietary interviews and diaries (evidence and opinion).

- *Appendix VI:* Methods for Performing Subjective Global Assessment
  - Healthcare professionals (e.g., physicians, dietitians and nurses) should undergo a brief training period before using SGA. This training is recommended to increase precision and skill in using SGA.
  - The four items currently used to assess nutritional status are weight change over the past six months; dietary intake and gastrointestinal symptoms; visual assessment of subcutaneous tissue; muscle mass
  - The scores of each of these items are summated to give the SGA rating
  - It is recommended that SGA be used to measure and monitor nutritional status periodically in both maintenance hemodialysis and peritoneal dialysis patients.
- *Appendix VII:* Methods for Performing Anthropometry and Calculating Body Measurements and Reference Tables
  - Standard body weight is the patient's actual weight (post-dialysis), expressed as a percentage of normal body weight for healthy Americans of similar sex, height and age range and skeletal frame size
  - Patients who are less than 90% of normal body weight are considered to be mildly to moderately malnourished and those who are less than 70% of normal body weight are considered severely malnourished
  - Individuals who are 115% to 130% of SBW are considered mildly obese, those between 130% and 150% are moderately obese and those above 150% of SBW are considered to be severely obese
  - Therefore, it is recommended that a target body weight for maintenance dialysis patients is between 90% and 110% of SBW
  - At present, it is recommended that the NHANES II data be used for the reference source
  - Measuring skinfold thickness at four sites (triceps, biceps, subscapular and iliac crest) that quantify subcutaneous adipose tissue thickness on the limbs and trunk can make an accurate assessment of body fat
  - In a study that measured four-site skinfold anthropometry, a reduction in percentage total body fat was observed in a group of maintenance hemodialysis patients, when compared with controls. Loss of fat from subcutaneous stores occurs proportionally. Therefore, repeated measures in the same patient over time may provide useful information on trends of fat stores.

- Recommendation Strength Rationale

  - Conclusion statement received Grade II
  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure.
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines.
  - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  How are different methods for measuring body composition compared in CKD patients, and which method was the preferred one?

  - References

    Avesani CM, Draibe SA, Kamimura MA, Cendoroglo M, Pedrosa A, Castro ML, Cuppari L.A. Assessment of body composition by dua energy X-ray absorptiometry, skinfold thickness and creatinine kinetics in chronic kidney disease patients. *Neprhol Dial Transplant*. 2004; 19: 2289-2295.

    Barreto Silva MI, Avesani CM, Vale B, Lemos C, Bregman R. Agreement between anthropometry and bioelectrical impedance for measuring body fat in nonobese and obese nondialyzed chronic kidney disease patients. *J Ren Nutr*. 2008; 18(4): 355-362.

    Bellizi V, Scalfi L, Terraciano V, De Nicola L, Minutolo R, Marra M, Guida B, Cianciaruso B, Conte G, Di Iorio BR. Early changes in bioelectrical estimates of body composition in chronic kidney disease. *J Am Soc Nephrol*. 2006; 17: 1481-1487.

    Heimburger O, Quereshi AR, Blaner WS, Berglund L, Stenvinkel P. Hand-grip muscle strength, lean body mass, and plasma proteins as markers of nutritional status in patients with chronic renal failure close to start of dialysis therapy. *Am J Kidney Dis*. 2000; 36(6): 1,213-1,225.

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    Sanches MR, Avesani CM, Kamimura MA, Lemaos MM, Axelsson J, Vasselai P, Draibe SA, Cuppari L. Waist circumference and visceral fat in CKD: A cross-sectional study. *Am J Kidney Dis*. 2008; 52: 66-73.

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- References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

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  - Guideline 23 (Panels of Nutrition Measures for Non-Dialyzed Patients): http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_a23.html
  - Appendix VI (Methods for Performing Subjective Global Assessment): http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_appx06a.html
  - Appendix VII (Methods for Performing Anthropometry and Calculating Body Measurements and Reference Tables): http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_appx07a.html.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Assessment of Biochemical Parameters 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Assess Biochemical Parameters

The registered dietitian (RD) should assess various biochemical parameters in adults with chronic kidney disease (CKD, including post-kidney transplant), related to:

- Glycemic control
- Protein-energy malnutrition
- Inflammation
- Kidney function
- Mineral and bone disorders
- Anemia
- Dyslipidemia
- Electrolyte disorders
- Others as appropriate.

For list of biochemical parameters, click here.

Assessment of the above factors is needed to effectively determine the nutrition diagnoses and nutrition prescription in adults with CKD and post-kidney transplant.

Rating: Consensus
Imperative

- Risks/Harms of Implementing This Recommendation

  Hydration status and impact of medications should be considered when assessing biochemical parameters.

- Conditions of Application

  No conditions specified.

- Potential Costs Associated with Application

  - Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are

essential for improved outcomes
- Accessibility and costs of biochemical parameter testing should be considered.

- Recommendation Narrative

Subsequent to the publication of the guideline reference below, terminology has been updated.

From the KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure (2000)

Guideline 23: Panels of Nutrition Measures for Nondialyzed Patients

- For individuals with CRF (GFR less than 20ml per minute) protein-energy nutritional status should be evaluated by serial measurements of a panel of markers including at least one value from each of the following clusters:
    1. Serum albumin
    2. Edema-free actual body weight, percentage standard (NHANES II) body weight or subjective global assessment (SGA)
    3. Normalized protein nitrogen appearance (nPNA) or dietary interviews and diaries (Evidence and Opinion).

From the KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease (2003)

Guideline 1: Evaluation of Calcium and Phosphorus Metabolism

- 1.1: Serum levels of calcium, phosphorus and intact plasma parathyroid hormone (PTH) should be measured in all patients with CKD and GFR less than 60ml per minute per 1.73m^2 (Evidence). The frequency of these measurements should be based on the stage of CKD (Opinion).
- 1.2: These measurements should be made more frequently if the patient is receiving concomitant therapy for the abnormalities in the serum levels of calcium, phosphorus or PTH, as detailed in Guidelines 4, 5, 7 and 8 and in transplant recipient, Guideline 16.

Guideline 6: Serum Calcium and Calcium-Phosphorus Product

- In CKD Patients (Stages 3 and 4)
    - 6.1: The serum levels of corrected total calcium should be maintained within the "normal" range for the laboratory used (Evidence).
- In CKD Patients (Stages 3 to 5)
    - 6.5: The serum calcium-phosphorus product should be maintained at less than 55mg^2 per dL^2 (Evidence). This is best achieved by controlling serum levels of phosphorus within the target range (Opinion).

Guideline 7: Prevention and Treatment of Vitamin D Insufficiency and Vitamin D Deficiency in CKD Patients

- In CKD Patients (Stages 3 and 4)
    - 7.1: If plasma intact PTH is above the target range for the stage of CKD, serum 25-hydroxyvitamin D should be measured at first encounter. If it is normal, repeat annually (Evidence).

Guideline 15: Metabolic Acidosis

- 15.1: In CKD Stages 3, 4 and 5, the serum level of total CO_2 should be measured.

Guideline 16: Bone Disease in the Kidney Transplant Recipient

- 16.1: Serum levels of calcium, phosphorus, total CO_2 and plasma intact PTH should be monitored following kidney transplantation (Opinion)
- 16.5: Treatment of disturbances in bone and mineral metabolism is determined by the level of kidney function in the transplant recipient as provided in Guidelines 1 through 15 for CKD patients (Opinion).

From the KDOQI Clinical Practice Guidelines for Anemia in Chronic Kidney Disease (2006)

Guideline II: Clinical Practice Guidelines and Clinical Practice Recommendations for Anemia in Chronic Kidney Disease in Adults

- CPR 1.1: Identifying Patients and Initiating Evaluation
    - 1.1.1 (Stage and cause of CKD): In the opinion of the Work Group, Hb testing should be carried out in all patients with CKD, regardless of stage or cause
    - 1.1.3 (Diagnosis of anemia): In the opinion of the Work Group, diagnosis of anemia should be made and further evaluation should be undertaken at the following Hb concentrations: less than 13.5g per dL in adult males; less than 12.0g per dL in adult females.

CPR 1.2: Evaluation of Anemia in CKD

- 1.2.1: In the opinion of the Work Group, initial assessment of anemia should include the following tests:
    - 1.2.1.1: A complete blood count (CBC) including, in addition to the Hb concentration, red blood cell indices [mean corpuscular hemoglobin (MCH), mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), white blood cell count and differential and platelet count]
    - 1.2.1.2: Absolute reticulocyte count
    - 1.2.1.3: Serum ferritin to assess iron stores
    - 1.2.1.4: Serum TSAT or content of Hb in reticulocytes (CHr) to assess adequacy of iron for erythropoiesis.

- Recommendation Strength Rationale

- The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for:
    - Nutrition in Chronic Renal Failure
    - Bone Metabolism and Disease in Chronic Kidney Disease
    - Anemia in Chronic Kidney Disease.
- The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence

analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.

- During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
- Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  - References
  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
    - Nutrition in Chronic Renal Failure: http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_a23.html
    - Bone Metabolism and Disease in Chronic Kidney Disease: http://www.kidney.org/professionals/kdoqi/guidelines_bone/index.htm
    - Anemia in Chronic Kidney Disease: http://www.kidney.org/professionals/kdoqi/guidelines_anemia/index.htm

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Assess CKD-Mineral and Bone Disorders 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Assess CKD-Mineral and Bone Disorders

  The registered dietitian (RD) should assess measurements of mineral and bone disorders (MBD) in adults with chronic kidney disease (CKD, including post kidney transplant) for prevention and treatment. Adults with CKD have altered mineral-bone metabolism and increased risk of vascular disease.

  Rating: Consensus
  Imperative

  - Risks/Harms of Implementing This Recommendation

    Bone density assessment may be contraindicated in pregnancy.

  - Conditions of Application

    No conditions specified.

  - Potential Costs Associated with Application

    - Cost of equipment, supplies and staff needs to be addressed in bone density assessment
    - Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

  - Recommendation Narrative

    From the KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease (2003)

    - *Guideline Two: Assessment of Bone Disease Associated with CKD*
      - 2.3: Bone radiographs are not indicated for the assessment of bone disease of CKD (evidence), but they are useful in detecting severe peripheral vascular calcification (opinion) and bone disease due to beta$_2$-microglobulin amyloidosis (Evidence)
      - 2.4: Bone mineral density (BMD) should be measured by dual energy X-ray absorptiometry

(DEXA) in patients with fractures and in those with known risk factors for osteoporosis (Opinion).
- *Guideline 16: Bone Disease in the Kidney Transplant Recipient*
  - 16.4: Kidney transplant recipients should have bone mineral density (BMD) measured by dual-energy X-ray absorptiometry to assess the presence or development of osteoporosis (Opinion)
  - 16.4a: DEXA scans should be obtained at time of transplant, one year and two years post-transplant (Opinion).

- Recommendation Strength Rationale

  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
  - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- References
- References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

  - Pagenkemper JJ. Dyslipidemias in chronic kidney disease. In A Clinical Guide to Nutrition Care in Kidney Disease, edited by Laura Byham-Gray, PhD, RD, CNSD, and Karen Wiesen, MS, RD, *Renal Dietitians Dietetic Practice Group of the American Dietetic Association and the Council on Renal Nutrition of the National Kidney Foundation,* 2004.
  - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
  - Bone Metabolism and Disease in Chronic Kidney Disease: http://www.kidney.org/professionals/kdoqi/guidelines_bone/index.htm
  - Guideline 2: Assessment of Bone Disease Associated with CKD: http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide2.htm
  - Guideline 16: Bone Disease in the Kidney Transplant Recipient: http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide16.htm.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Assessment of Medical/Health History 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Assessment of Medical/Health History

When implementing medical nutrition therapy (MNT), the registered dietitian (RD) should assess the medical and health history of individuals with chronic kidney disease (CKD, including post kidney transplant) for the presence of other disease states and conditions, such as diabetes, hypertension, obesity and disorders of lipid metabolism. Adults with CKD, including post kidney transplant, have a higher prevalence of comorbidities, which are risk factors for the progression of kidney disease.

Rating: Strong
Imperative

- Risks/Harms of Implementing This Recommendation

  None.

- Conditions of Application

  No conditions specified.

- Potential Costs Associated with Application

  Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

  Subsequent to the publication of the guideline reference below, terminology has been updated.

  From the KDOQI Clinical Practice Guidelines on Hypertension and Antihypertensive Agents in Chronic Kidney Disease (2004)

  - *Guideline 1: Goals of Antihypertensive Therapy in CKD*
    - Hypertension is common in CKD and is a risk factor for faster progression of kidney disease and development and worsening of CVD
    - Some antihypertensive agents also slow the progression of kidney disease by mechanisms in addition to their antihypertensive effect.
  - *Guideline 2: Evaluation of Patients with CKD or Hypertension*
    - Careful initial evaluation and frequent re-evaluation are essential for effective treatment of hypertension and use of antihypertensive agents in CKD. Because CKD and hypertension are often present together and both are generally asymptomatic, Guideline 2 considers evaluations of patients with either condition.
      - 2.2: Initial evaluation should include the following elements:
        - 2.2.b: Presence of clinical CVD and CVD risk factors
        - 2.2.c: Comorbid conditions.
  - *Guideline 4: Evaluation for Renal Artery Disease*
    - Renal artery disease (RAD) is a cause of CKD and hypertension and can be present in patients with other causes of CKD, such as diabetes or hypertensive nephrosclerosis and CKD in the kidney transplant.

  From the KDOQI Clinical Practice Guidelines for Managing Dyslipidemias in Chronic Kidney Disease (2003)

  Guideline 1: All Adults and Adolescents with CKD Should Be Evaluated for Dyslipidemias

  From the KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease (2007)

  - *Guideline 1: Screening and Diagnosis of DKD*
    - CKD in patients with diabetes may or may not represent DKD. In the absence of an established diagnosis, the evaluation of patients with diabetes and kidney disease should include investigation into the underlying cause(s).
    - 1.1: Patients with diabetes should be screened annually for DKD. Initial screening should commence:
      - Five years after the diagnosis of type 1 diabetes or
      - From diagnosis of type 2 diabetes.
  - *Guideline 4: Management of Dyslipidemia in Diabetes and CKD*
    - Dyslipidemia is common in people with diabetes and CKD. The risk of CVD is greatly increased in this population. People with diabetes and CKD should be treated according to current guidelines for high-risk groups.

- Recommendation Strength Rationale

  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for:
    - Hypertension and Antihypertensive Agents in Chronic Kidney Disease
    - Managing Dyslipidemias in Chronic Kidney Disease
    - Diabetes and Chronic Kidney Disease.
  - Evidence includes results from well-designed, well-conducted studies in the target population that directly assess effects on health outcomes
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
  - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  - References
  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link:

http://www.kidney.org/professionals/KDOQI/
- Hypertension and Antihypertensive Agents in Chronic Kidney Disease: http://www.kidney.org/professionals/KDOQI/guidelines_bp/index.htm
- Managing Dyslipidemias in Chronic Kidney Disease: http://www.kidney.org/professionals/KDOQI/guidelines_lipids/toc.htm
- Diabetes and Chronic Kidney Disease: http://www.kidney.org/professionals/KDOQI/guideline_diabetes/.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Protein Intake 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Protein Intake for eGFR <50ml per minute per /1.73m2

For adults with chronic kidney disease (CKD) without diabetes, not on dialysis, with an eGFR below 50ml per minute per 1.73m^2, the registered dietitian (RD) should recommend or prescribe a protein-controlled diet providing 0.6g-0.8g dietary protein per kg of body weight per day. Clinical judgment should be used when recommending lower protein intakes, considering the client's level of motivation, willingness to participate in frequent follow-up and risk for protein-energy malnutrition. Research reports that protein-restricted diets (0.7g dietary protein per kg of body weight per day, ensuring adequate caloric intake) can slow GFR decline and maintain stable nutrition status in adult non-diabetic patients with CKD.

Rating: Strong
Conditional

CKD: Very-Low-Protein Intake for eGFR <20ml per minute per 1.73m2

In international settings where keto acid analogs are available, a very-low protein-controlled diet may be considered. For adults with CKD without diabetes, not on dialysis, with an eGFR below 20ml per minute per 1.73m^2, a very-low protein-controlled diet providing 0.3g to 0.5g dietary protein per kg of body weight per day with addition of keto acid analogs to meet protein requirements may be recommended. International studies report that additional keto acid analogs and vitamin or mineral supplementation are needed to maintain adequate nutrition status for patients with CKD who consume a very-low-protein controlled diet (0.3g to 0.5g per kg per day).

Rating: Strong
Conditional

CKD: Protein Intake for Diabetic Nephropathy

For adults with diabetic nephropathy, the RD should recommend or prescribe a protein-controlled diet providing 0.8g to 0.9g of protein per kg of body weight per day. Providing dietary protein at a level of 0.7g per kg of body weight per day may result in hypoalbuminemia. Research reports that protein-restricted diets improved microalbuminuria.

Rating: Fair
Conditional

CKD: Protein Intake for Kidney Transplant

For adult kidney transplant recipients (after surgical recovery, with an adequately functioning allograft), the RD should recommend 0.8g to 1.0g per kg of body weight per day for protein intake, addressing specific issues as needed. Adequate, but not excessive, protein intake supports allograft survival and minimizes impact on comorbid conditions.

Rating: Consensus
Conditional

- Risks/Harms of Implementing This Recommendation

  - For all recommendations, nutrition status must be maintained, including adequate caloric intake and maintenance of lean body mass. See recommendation onEnergy Intake.
  - Lower protein and energy intakes can lead to hypoalbuminemia, malnutrition, loss of lean body mass and unintentional weight loss
  - The effect of nephrotic syndrome on degree of proteinuria should be considered when evaluating hypoalbuminemia
  - The effect of diminished appetite secondary to uremia may impact overall intake
  - For CKD patients with hypophosphatemia or hyperphosphatemia, the RD should be aware that protein-controlled diets are typically lower in phosphorus content and therefore protein intake may affect phosphorus management
  - The impact of animal and vegetable protein on renal function should be considered; e.g. consumption of

red meat has been shown to increase albuminuria
- Since fluid retention affects interpretation of weight, the RD should be aware that protein calculations based on weight may need adjustment.

- Conditions of Application

  - For all recommendations, the motivation and willingness of the client to adhere to complicated nutrition regimes and participate in routine follow-up should be considered
  - For the *CKD: Protein Intake (Non-dialysis) for eGFR <50ml per minute per 1.73m^2* recommendation, this recommendation applies to adults with CKD without diabetes, not on dialysis, with an eGFR below 50ml per minute per 1.73m^2
  - For the *CKD: Very-Low-Protein Intake (Non-dialysis) for eGFR <20ml per minute per 1.73m^2* recommendation, this recommendation applies to adults with CKD without diabetes, not on dialysis, with an eGFR below 20ml per minute per 1.73m^2
  - For the *CKD: Protein Intake for Diabetic Nephropathy* recommendation, this recommendation applies to adults with CKD with diabetic nephropathy and assumes glycemic control
  - For the *CKD: Protein Intake for Kidney Transplant* recommendation, this recommendation applies to adult kidney transplant recipients after surgical recovery, with an adequately functioning graft
  - Current state laws and regulations which define the RD's scope of practice should be checked regarding interpretation of terms such as "write an order, " "order changes, " "initiate, " "recommend, " "prescribe, " etc. Nutrition prescription privileges may be granted to an RD by the governing body of the hospital or other practice settings. The governing body of the hospital or other practice settings via the medical staff bylaws may also designate an RD to receive and implement MD- OR DO-delegated orders or administer disease-specific or condition-specific patient care protocols, as approved and adopted by the facility or institution.
  - For more information, members of the American Dietetic Association can access www.eatright.org/quality. Under "Quality Management, " topics include Practice Resources, Regulatory, State Resources, Licensure and Accreditation Organization.

- Potential Costs Associated with Application

  Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

  For the *CKD: Protein Intake (Non-dialysis) for eGFR <50ml per minute per 1.73m^2* and *CKD: Very-Low-Protein Intake (Non-dialysis) for eGFR <20ml per minute per 1.73m^2* recommendations:

  - Meta-analysis results of nine RCTs published before 1999 suggest that non-diabetic CKD patients who were on dietary protein restriction diets had significantly reduced risk of renal failure (all-cause death or start of dialysis) and significantly reduced rate of GFR decline, compared to those on usual protein diets (Kopple et al, 1989; Walser et al, 1993; Ikizler et al, 1995; Levey et al, 1996; Kasiske et al, 1998; Teschan et al, 1998; Fouque et al, 2000)
  - RCTs (Bernhard et al, 2001; Meloni et al, 2004; Feiten et al, 2005; Mircescu et al, 2007) and other uncontrolled trials (Chauveau et al, 1999; Zakar et al, 2001; Kaizu et al, 2002; Chauveau et al, 2003; Ideura et al, 2007) published after the meta-analysis report consistent findings. These RCTs show that protein-restricted diets, inclusive of low and very-low protein diets, ranging from 0.3g to 0.7g per kg of body weight per day with total energy intake of 23kcal to 35kcal per kg body weight can slow GFR decline and maintain stable nutrition status in adult non-diabetic patients with chronic kidney disease (CKD).
  - International studies reported additional keto acid analogs and vitamin or mineral supplementation are needed to maintain adequate nutrition status for patients with CKD who consume a very-low protein diet (0.3g to 0.5g per kg body weight per day) (Teplan et al, 2001).
  - Limited evidence suggests that adding keto acid supplements is better than amino acid supplements to slow GFR decline among non-diabetic CKD patients who received a very low-protein diet (0.3g per kg body weight per day).

  For the *CKD: Protein Intake for Diabetic Nephropathy* recommendation:

  - Meta-analysis results of four RCTs and two non-RCTs published before 1996 suggest that patients with diabetic nephropathy who were on dietary protein restriction diets had significantly reduced rates of GFR decline compared to those on usual protein diets (Pedrini et al, 1996; Kasiske et al, 1998). However, seven later RCTs involving about four times more patients than the meta-analysis show conflicting findings. Specifically, more recent RCTs (published after 1999) show that a low-protein diet (0.6g to 0.89g per kg per day) without ketoacid supplementation for up to two years did not significantly alter GFR decline when compared to subjects' usual protein diet (1.0g to 1.4g per kg per day), regardless of the stage of CKD or type of diabetes among patients with diabetic nephropathy (Hansen et al, 1999; Meloni et al, 2002; Pijls et al, 2002; Meloni et al, 2004; Dussol et al, 2005). The reported effects on proteinuria or microalbuminuria were inconsistent across studies. Nutrition status can be maintained with either a low protein or a usual protein diet.
  - Data on the effects of protein-restriction diets on clinical outcomes of renal function are limited. One positive RCT shows that the relative risk of progression to Stage Five CKD or overall mortality was significantly reduced [0.23 (95% CI, 0.07, 0.72), P=0.01] for type 1 diabetes patients assigned to a low-protein diet (0.89g per kg per day), compared to those assigned to a free-protein diet (Hansen et al, 2002).
  - Results from one RCT suggests that ketoacid supplementation may be needed to preserve renal function among patients who are on a very-low protein diet (0.3g per kg per day) (Prakash et al, 2004).

  For the *CKD: Protein Intake for Kidney Transplant* recommendation:

  - Results from one study of kidney transplant patients with declined graft function (GFR less than 60ml per minute per 1.73m^2) suggest that a low-protein diet (0.55g per kg per day) can reduce proteinuria compared to a high-protein diet (2.0g per kg per day) (Salahudeen et al, 1992)
  - Due to limited research in kidney transplant patients, the Expert Work Group believed that a Consensus recommendation for normal protein allowances was appropriate.

- Recommendation Strength Rationale
  - For the *CKD: Protein Intake (Non-dialysis) for eGFR <50ml per minute per 1.73m^2* recommendation, the conclusion statement received Grade I
  - For the *CKD: Very-Low-Protein Intake (Non-dialysis) for eGFR <20ml per minute per 1.73m^2* recommendation, the conclusion statement received Grade I
  - For the *CKD: Protein Intake for Diabetic Nephropathy* recommendation, the conclusion statement received Grade II
  - For the *CKD: Protein Intake for Kidney Transplant* recommendation, the conclusion statement received Grade III.
- Minority Opinions

  Consensus reached.

- Supporting Evidence

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

What are the protein requirements to minimize disease progression while maintaining adequate nutrition status in adult non-dialyzed patients with diabetic nephropathy?

What are the protein requirements to minimize disease progression while maintaining adequate nutrition status in adult non-dialyzed, non-diabetic patients with chronic kidney disease?

What are the protein requirements to minimize disease progression while maintaining adequate nutrition status in adult non-dialyzed patients with kidney transplant?

- References

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- Diabetes and Chronic Kidney Disease: http://www.kidney.org/professionals/KDOQI/guideline_diabetes/.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Energy Intake 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Energy Intake

For adults with chronic kidney disease (CKD, including post kidney transplant after surgical recovery), the registered dietitian (RD) should recommend or prescribe an energy intake between 23kcal to 35kcal per kg of body weight per day, based on the following factors:

- Weight status and goals
- Age and gender
- Level of physical activity
- Metabolic stressors.

Research reports that energy intakes between 23kcal to 35kcal per kg body weight per day are adequate to prevent signs of malnutrition.

Rating: Fair
Imperative

- Risks/Harms of Implementing This Recommendation

  If an adult with CKD is not under the care of an RD, there is an increased risk of protein-energy malnutrition.

- Conditions of Application

  Current state laws and regulations which define the RD's scope of practice should be checked regarding interpretation of terms such as "write an order, " "order changes, " "initiate, " "recommend, " "prescribe, " etc. Nutrition prescription privileges may be granted to an RD by the governing body of the hospital or other practice settings. The governing body of the hospital or other practice settings via the medical staff bylaws may also designate an RD to receive and implement MD- or DO-delegated orders or administer disease-specific or condition-specific patient care protocols, as approved and adopted by the facility or institution.

  For more information, members of the American Dietetic Association can access www.eatright.org/quality. Under "Quality Management, " topics include Practice Resources, Regulatory, State Resources, Licensure and Accreditation Organization.

- Potential Costs Associated with Application

  Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

  CKD Patients: Normal Body Weight

  Data from five RCTs (Bernhard et al, 2001; Teplan et al, 2001; Meloni et al, 2004; Feiten et al, 2005; Mircescu et al, 2007) of patients with normal body weight suggest that a total energy intake of 23kcal to 35kcal per kg body weight (when consuming protein-restricted diets ranging from 0.3g to 0.7g per kg per day) is adequate to maintain stable BMI in adult non-diabetic patients with CKD. Other uncontrolled trials (Ikizler et al, 1995; Chauveau et al, 1999; Zakar et al, 2001; Kaizu et al, 2002; Chauveau et al, 2003; Ideura et al, 2007) and cross-sectional studies (Monteon et al, 1986; Kuhlmann et al, 2001) suggest similar findings.

  CKD Patients: Overweight with Diabetes

  Data from three RCTs (Meloni et al, 2002; Meloni et al, 2004; Dussol et al, 2005) of overweight CKD patients (mean BMI of approximately 27) with type 1 or type 2 diabetes suggest that a total energy intake of 1, 780kcal to 1, 823kcal (when consuming protein-restricted diets ranging from 0.68g to 0.86g per kg per day) can decrease body weight without resulting signs of malnutrition.

  Post-Kidney Transplant Patients

  Data from one before-and-after trial (Teplan et al, 2003) of obese (mean BMI, 35.5) hyperhomocysteinuric patients (definition not given) with a new kidney transplant (one year post-transplantation), suggest that a diet of less than 30kcal per kg per day can significantly reduce BMI (mean BMI, -8kg/m^2; P<0.03), LDL-cholesterol (-38mg per dL; P<0.01) and TG (-102mg per dL; P<0.01) after one year.

  From the KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure (2000)

  Guideline 25: Dietary Energy Intake (DEI) for Non-Dialyzed Patients

  - The recommended DEI for individuals with chronic renal failure (CRF: GFR<25ml per minute) who are not undergoing maintenance dialysis is 35kcal per kg per day for those who are younger than 60 years old and 30kcal to 35kcal per kg per day for individuals who are 60 years of age or older (Evidence and Opinion)
  - Energy expenditure of non-dialyzed individuals with CRF is similar to that of healthy individuals
  - Metabolic balance studies of such individuals indicate that a diet providing about 35kcal per kg per day engenders neutral nitrogen balance and maintains serum albumin and anthropometric indices
  - Because individuals over 60 years of age tend to be more sedentary, a lower total energy intake of 30kcal to 35kcal per kg per day is acceptable.

- Recommendation Strength Rationale

  - Conclusion statement in support of this recommendation was given Grade II
  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines.

- Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  What are the energy requirements in adult non-dialyzed patients with chronic kidney disease, diabetic nephropathy or kidney transplant?

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- References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

  National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link:

  http://www.kidney.org/professionals/KDOQI/

  Guideline 25: Dietary Energy Intake (DEI) for Non-dialyzed Patients:

  http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_a25.html

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Phosphorus 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Phosphorus

  For adults with chronic kidney disease (CKD Stages Three to Five), the registered dietitian (RD) should recommend or prescribe a low-phosphorus diet providing 800mg to 1, 000mg per day or 10mg to 12mg phosphorus per gram of protein. CKD patients have a predisposition for mineral and bone disorders. Phosphorus control is the cornerstone for the treatment and prevention of secondary hyperparathyroidism, renal bone disease and soft tissue calcification.

Rating: Strong
Conditional

CKD: Adjust Phosphate Binders

For adults with CKD (Stages Three to Five), the dose and timing of phosphate binders should be individually adjusted to the phosphate content of meals and snacks to achieve desired serum phosphorus levels. Serum phosphorus levels are difficult to control with dietary restrictions alone.

Rating: Strong
Conditional

CKD: Phosphorus Management for Kidney Transplant

For adult kidney transplant recipients exhibiting hypophosphatemia, the registered dietitian (RD) should recommend or prescribe a high-phosphorus intake (diet or supplements) to replete serum phosphorus as needed. Hypophosphatemia is common post kidney transplant.

Rating: Consensus
Conditional

- Risks/Harms of Implementing This Recommendation
  - Hypophosphatemia and hyperphosphatemia are associated with increased morbidity and mortality
  - Following initiation of vitamin D therapy, the use of cholecalciferol or ergocalciferol therapy should be coordinated with the serum calcium and phosphorus levels
  - The RD should be aware of calcium- and vitamin D-fortified foods and phosphorus-enhanced products
  - The RD should be aware of the risks of hypercalcemia, such as soft tissue calcification, altered mental status, tetany, cardiac events and other adverse effects.
- Conditions of Application
  - These recommendations apply to adults with CKD (Stages Three to Five) and post kidney transplant recipients exhibiting hypophosphatemia
  - Current state laws and regulations which define the RDs scope of practice should be checked regarding interpretation of terms such as "write an order, " "order changes, " "initiate, " "recommend, " "prescribe, " etc. Nutrition prescription privileges may be granted to an RD by the governing body of the hospital or other practice settings. The governing body of the hospital or other practice settings via the medical staff bylaws may also designate an RD to receive and implement MD- or DO-delegated orders or administer disease-specific or condition-specific patient care protocols, as approved and adopted by the facility or institution.
  - For more information, members of the American Dietetic Association can access www.eatright.org/quality. Under "Quality Management, " topics include Practice Resources, Regulatory, State Resources, Licensure and Accreditation Organization.
- Potential Costs Associated with Application

  Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes
- Recommendation Narrative
  - Hyperphosphatemia and the associated conditions begin to appear as GFR declines below 60ml per minute. Hyperphosphatemia, elevated parathyroid hormone (PTH), secondary hyperparathyroidism with depressed serum calcium and vitamin D deficiency are metabolic disturbances that require early detection and treatment to prevent bone disease of chronic hyperparathryoidism and to minimize the increased risk for cardiovascular disease. Evaluating, preventing and monitoring hyperparathyroidism requires data on serum calcium, serum phosphate and intact-PTH.
  - Treatment needs to be individualized and may include dietary phosphate restriction or phosphate binders and calcium and vitamin D supplementation and self-management training. Dietary phosphorus intakes are correlated with dietary protein intakes. Therefore, diets restricted in protein are also lower in phosphorus (Delmez et al, 1992; Combe et al, 1995; Kates et al, 1997; Martinez et al, 1997; Cannata-Andia et al, 2000).

  From the KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease (2003)

  Guideline 4: Restriction of Dietary Phosphorus in Patients with CKD

  - 4.1: Dietary phosphorus should be restricted to 800mg to 1, 000mg per day (adjusted for dietary protein needs) when the serum phosphorus levels are elevated [over 4.6mg per dL (1.49mmol per L)] at Stages Three and Four of CKD (Opinion) and over 5.5mg per dL (1.78mmol per L) in those with kidney failure (Stage Five) (Evidence)
  - 4.2: Dietary phosphorus should be restricted to 800mg to 1, 000mg per day (adjusted to dietary protein needs) when the plasma level of intact PTH are elevated above target range of the CKD stage (Evidence).

  Guideline 5: Use of Phosphate Binders in CKD

  - In CKD Patients (Stages Three and Four)
    - 5.1: If phosphorus or intact PTH levels cannot be controlled within the target range, despite dietary phosphorus restriction, phosphate binders should be prescribed (Opinion)
    - 5.2: Calcium-based phosphate binders are effective in lowering serum phosphorus levels (Evidence) and may be used as the initial binder therapy (Opinion).

  Guideline 13: Treatment of Bone Disease in CKD

  - Guideline 13A: Hyperparathyroid (High Turnover) and Mixed (High Turnover with Mineralization Defect)

Bone Disease
    - 13A.1: In CKD patients (Stages Three and Four) who have plasma levels of intact PTH over 70pg per ml (7.7pmol per L) (Stage Three) or over 110pg per ml (12.1pmol per L) (Stage Four) on more than two consecutive measurements, dietary phosphate intake should be restricted. If this is ineffective in lowering plasma PTH levels, calcitriol, (Evidence) or one of its analogs [alfacalcidol (evidence) or doxercalciferol (opinion)] should be given to prevent or ameliorate bone disease.
- Guideline 13B: Osteomalacia
    - 13B.3: Osteomalacia due to vitamin D_2 or D_3 deficiency or phosphate depletion, though uncommon, should be treated with vitamin D_2 or D_3 supplementation or phosphate administration, respectively (Opinion)
    - 13B.3a: If osteomalacia due to vitamin D deficiency fails to respond to ergocalciferol or cholecalciferol, particularly in patients with kidney failure (Stage Five), treatment with an active vitamin D sterol may be given (Opinion)
    - 13B.3b: Doses of phosphate supplementation should be adjusted upwards until normal serum levels of phosphorus are achieved (Opinion).

Guideline 16: Bone Disease in the Kidney Transplant Recipient

- 16.2: During the first week after kidney transplantation, serum levels of phosphorus should be measured daily. Kidney transplant recipients who develop persistently low levels of serum phosphate [under 2.5mg per dL (0.81mmol per L)] should be treated with phosphate supplementation (Opinion).

- Recommendation Strength Rationale

    - Conclusion statement received Grade II
    - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease
    - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
    - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
    - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

    Consensus reached.

- Supporting Evidence

    The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

    What does the research indicate about hyperphosphatemia in chronic kidney disease?

    - References

        Cannata-Andia J, Passlick-Deetjen J, Ritz E (eds). Management of the renal patient: experts' recommendations and clinical algorithms on renal osteodystrophy and cardiovascular risk factors. *Nephrol Dial Transplant* 2000; 15 (suppl 5):39-57.

        Combe C, Morel D, de Precigout V, Blanchetier V, Bouchet JL, Potaux L, Fournier A, Aparicio M. Long-term control of hyperparathyroidism in advanced renal failure by low-phosphorus low-protein diet supplemented with calcium (without changes in plasma calcitriol). *Nephron* 1995; 70(30):287-295.

        Delmez JA, Slatopolsky E. Hyperphosphatemia: Its consequences and treatment in patients with chronic renal disease. *Am J Kidney Diseases* 1992; 19:303-317.

        Kates DM, Sherrard DJ, Andress DL. Evidence that serum phosphate is independently associated with serum PTH in patients with chronic renal failure. *Am J Kidney Diseases* 1997;30:809-813.

        Martinez I, Saracho R, Montenegro J, Llach F. The importance of dietary calcium and phosphorous in the secondary hyperparathyroidism of patients with early renal failure. *Am J Kidney Dis* 1997;29(4):496-502.

    - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

        - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
        - Guideline 4 (Restriction of Dietary Phosphorus in Patients with CKD): http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide4.htm
        - Guideline 5 (Use of Phosphate Binders in CKD): http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide5.htm
        - Guideline 13 (Treatment of Bone Disease in CKD)
        - Guideline 13A [Hyperparathyroid (High-Turnover) and Mixed (High Turnover with Mineralization Defect) Bone Disease]: http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide13A.htm
        - Guideline 13B (Osteomalacia): http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide13B.htm
        - Guideline 16 (Bone Disease in the Kidney Transplant Recipient): http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide16.htm.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Calcium 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Calcium

For adults with chronic kidney disease (CKD Stages Three to Five, including post kidney transplant), the registered dietitian (RD) should recommend a total elemental calcium intake (including dietary calcium, calcium supplementation and calcium-based phosphate binders) not exceeding 2, 000mg per day. CKD patients have a predisposition for mineral and bone disorders. Serum calcium concentration is the most important factor regulating parathyroid hormone (PTH) secretion affecting bone integrity and soft tissue calcification.

Rating: Consensus
Conditional

- Risks/Harms of Implementing This Recommendation
  - Following initiation of vitamin D therapy, the use of cholecalciferol or ergocalciferol therapy should be coordinated with the serum calcium and phosphorus levels
  - The RD should be aware of calcium and vitamin D fortified foods and phosphorus enhanced products
  - The RD should be aware of the risks of hypercalcemia, such as soft tissue calcification, altered mental status, tetany, cardiac events and other adverse effects.
- Conditions of Application

  This recommendation applies to adults with CKD (Stages Three to Five) and post kidney transplant.
- Potential Costs Associated with Application

  Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.
- Recommendation Narrative

  From the KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease (2003)

  Guideline Six: Serum Calcium and Calcium-Phosphorus Product

  - In CKD Patients (Stages Three to Five)
    - 6.4: Total elemental calcium intake (including both dietary calcium intake and calcium-phosphate binders) should not exceed 2, 000mg per day (Opinion)
    - 6.6: Patients whose serum levels of corrected total calcium are below the lower limit for the laboratory used [less than 8.4mg per dL (2.10mmol per L)] should receive therapy to increase serum calcium if:
      - 6.6a: There are clinical symptoms of hypocalcemia such as paresthesia, Chvostek's and Trousseau's signs, bronchospasm, laryngospasm, tetany or seizures (Opinion)
      - or 6.6b: The plasma intact PTH level is above the target range for the CKD Stage (Opinion).
    - 6.7: Therapy for hypocalcemia should include calcium salts such as calcium carbonate (Evidence) or oral vitamin D sterols (Evidence).

  Guideline 13: Treatment of Bone Disease in CKD

  - Guideline 13A: Hyperparathyroid (High Turnover) and Mixed (High Turnover with Mineralization Defect) Bone Disease
    - 13A.1: In CKD patients (Stages Three and Four) who have plasma levels of intact PTH above 70pg per ml (7.7pmol per L) (Stage Three) or over 110pg per ml (12.1pmol per L) (Stage Four) on more than two consecutive measurements, dietary phosphate intake should be restricted. If this is ineffective in lowering plasma PTH levels, calcitriol (Evidence) or one of its analogs [alfacalcidol (Evidence) or doxercalciferol (Opinion)] should be given to prevent or ameliorate bone disease.
  - Guideline 13B: Osteomalacia
    - 13B.3: Osteomalacia due to vitamin D_2 or D_3 deficiency or phosphate depletion, though uncommon, should be treated with vitamin D_2 or D_3 supplementation or phosphate administration, respectively (Opinion)
    - 13B.3a: If osteomalacia due to vitamin D deficiency fails to respond to ergocalciferol or cholecalciferol, particularly in patients with kidney failure (Stage Five), treatment with an active vitamin D sterol may be given (Opinion)
    - 13B.3b: Doses of phosphate supplementation should be adjusted upwards until normal serum levels of phosphorus are achieved (Opinion).
- Recommendation Strength Rationale
  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded

when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
- During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
- Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

Consensus reached.

- Supporting Evidence

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- References
- References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

  - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
  - Guideline 6 (Serum Calcium and Calcium-Phosphorus Product): http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide6.htm
  - Guideline 13 (Treatment of Bone Disease in CKD)
    - http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide13A.htm
    - http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide13B.htm.
  - KDIGO Guideline for Chronic Kidney Disease - Mineral and Bone Disorder (CKD-MBD) Clinical Practice Guidelines are accessible at the following link: http://www.kdigo.org/clinical_practice_guidelines/kdigo_guideline_for_ckd-mbd.php.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Vitamin D Therapy 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Vitamin D Supplementation

In adults with chronic kidney disease (CKD, including post kidney transplant), the registered dietitian (RD) should recommend vitamin D supplementation to maintain adequate levels of vitamin D if the serum level of 25-hydroxyvitamin D is less than 30ng per ml (75nmol per L). CKD patients have a predisposition for mineral and bone disorders, as well as other conditions that may be affected by insufficient vitamin D. Sufficient vitamin D should be recommended to maintain adequate levels of serum vitamin D.

Rating: Consensus
Conditional

- Risks/Harms of Implementing This Recommendation

  - Following initiation of vitamin D therapy, the use of cholecalciferol or ergocalciferol therapy should be coordinated with the serum calcium and phosphorus levels
  - The RD should be aware of calcium- and vitamin D-fortified foods and phosphorus-enhanced products
  - The RD should be aware of the risks of hypercalcemia, such as soft tissue calcification, altered mental status, tetany, cardiac events and other adverse effects.

- Conditions of Application

These recommendations apply to individuals with CKD, with serum levels of 25-hydroxyvitamin D below 30ng per ml (75nmol per L).

- Potential Costs Associated with Application

Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

From the KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney

Disease (2003)

Guideline 7: Prevention and Treatment of Vitamin D Insufficiency and Vitamin D Deficiency in CKD Patients

- In CKD Patients (Stages Three and Four)
  - 7.2: If the serum level of 25-hydroxyvitamin D is less than 30ng per ml (75mmol per L), supplementation with vitamin D_2 (ergocalciferol) should be initiated (Opinion).
  - 7.3: Following initiation of vitamin D therapy:
    - 7.3a: The use of ergocalciferol therapy should be integrated with the serum calcium and phosphorus
    - 7.3b: The serum levels of corrected total calcium and phosphorus should be measured at least every three months (Opinion)
    - 7.3c: If the serum levels of corrected total calcium exceeds 10.2mg per dL (2.54mmol per L), discontinue ergocalciferol therapy and all forms of vitamin D therapy (Opinion)
    - 7.3d: If the serum phosphorus exceeds 4.6mg per dL (1.49mmol per L), add or increase the dose of phosphate binder. If hyperphosphatemia persists, discontinue vitamin D therapy (Opinion).
    - 7.3e: Once patients are replete with Vitamin D, continued supplementation with a Vitamin D-containing multi-vitamin preparation should be used with annual reassessment of serum levels of 25-hydroxyvitamin D and the continued assessment of corrected total calcium and phosphorus every three months (Opinion).

Guideline 8: Vitamin D Therapy in CKD Patients

- Guideline 8A: Active Vitamin D Therapy in Patients with Stages Three and Four CKD
  - 8A.1: In patients with CKD Stages Three and Four, therapy with an active oral vitamin D sterol (calcitriol, alfacalcidol or doxecalciferol) is indicated when serum levels of 25(OH)-vitamin D are more than 30ng per ml (75nmol per L) and plasma levels of intact PTH are above the target range for the CKD stage (Evidence)
    - 8A.1a: Treatment with an active vitamin D sterol should be undertaken only in patients with serum levels of corrected total calcium less than 9.5mg per dL (2.37mmol per L) and serum phosphorus less than 4.6mg per dL (1.49mmol per L) (Opinion)
    - 8A.1b: Vitamin D sterols should not be prescribed for patients with rapidly-worsening kidney function or those who are non-compliant with medications or follow-up (Opinion).
  - 8A.2: During therapy with vitamin D sterols, serum levels of calcium and phosphorus should be monitored at least every month after initiation of therapy for the first three months, then every month thereafter. Plasma PTH levels should be measured at least every three months for six months and every three months thereafter (Opinion).
  - 8A.3: Dosage adjustments for patients receiving active vitamin D sterol therapy should be made as follows:
    - 8A.3a: If plasma levels of intact PTH fall below the target range for the CKD stage, hold active vitamin D sterol therapy until plasma levels of intact PTH rise to above the target range, then resume treatment with the dose of active vitamin D sterol reduced by half. If the lowest daily dose of the active vitamin D sterol is being used, reduce to alternate-day dosing (Opinion).
    - 8A.3b: If serum levels of corrected total calcium exceed 9.5mg per dL (2.37mmol per L), hold active vitamin D sterol therapy until serum calcium returns to less than 9.5mg per dL (2.37mmol per L), then resume treatment at half the previous dose. If the lowest daily dose of the active vitamin D sterol is being used, reduce to alternate-day dosing (Opinion).
    - 8A.3c: If serum levels of phosphorus rise to more than 4.6mg per dL (1.49mmol per L), hold active vitamin D therapy, initiate or increase dose of phosphate binder until the levels of serum phosphorus fall to less than 4.6mg per dL (1.49mmol per L), then resume the prior dose of active vitamin D sterol (Opinion).

Guideline 13: Treatment of Bone Disease in CKD

- Guideline 13B: Osteomalacia
  - 13B.3: Osteomalacia due to vitamin D_2 or D_3 deficiency or phosphate depletion, though uncommon, should be treated with vitamin D_2 or D_3 supplementation and phosphate administration, respectively (Opinion):
    - 13B.3a: If osteomalacia due to vitamin D deficiency fails to respond to ergocalciferol or cholecalciferol, particularly in patients with kidney failure (Stage Five), treatment with an active vitamin D sterol may be given (Opinion).
    - 13B.3b: Doses of phosphate supplementation should be adjusted upwards until normal serum levels of phosphorus are achieved (Opinion).

- Recommendation Strength Rationale

  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
  - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- References
- References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

  - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
  - *Guideline 7:* Prevention and Treatment of Vitamin D Insufficiency and Vitamin D Deficiency in CKD Patients: http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide7.htm
  - *Guideline 8:* Vitamin D Therapy in CKD Patients: http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide8A.htm
  - *Guideline 13:* Treatment of Bone Disease in CKD: http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide13B.htm
  - KDIGO Guideline for Chronic Kidney Disease - Mineral and Bone Disorder (CKD-MBD) Clinical Practice Guidelines are accessible at the following link: http://www.kdigo.org/clinical_practice_guidelines/kdigo_guideline_for_ckd-mbd.php.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Anemia 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Iron Supplementation

In adults with chronic kidney disease (CKD, including post kidney transplant), the registered dietitian (RD) should recommend oral or IV iron administration if serum ferritin is below 100ng per ml and TSAT is below 20%. CKD patients have a predisposition for anemia. Sufficient iron should be recommended to maintain adequate levels of serum iron to support erythropoiesis.

Rating: Consensus
Conditional

CKD: Vitamin B12 and Folic Acid for Anemia

In adults with CKD (including post kidney transplant), the RD should recommend vitamin B_{12} and folic acid supplementation if the MCV is over 100ng per ml and serum levels of these nutrients are below normal values. CKD patients have a predisposition for anemia and all potential causes should be investigated.

Rating: Consensus
Conditional

CKD: Vitamin C for Treatment of Anemia

If the use of vitamin C supplementation is proposed as a method to improve iron absorption for adults with CKD (including post kidney transplant) who are anemic, the RD should recommend the DRI for vitamin C. There is insufficient evidence to recommend the use of vitamin C supplementation above the DRI in the management of anemia in patients with CKD, due to risk of hyperoxalosis.

Rating: Consensus
Conditional

CKD: L-Carnitine for Treatment of Anemia

For adults with CKD (including post kidney transplant) who are anemic, the RD should *not* recommend L-carnitine supplementation. There is insufficient evidence to recommend the use of L-carnitine in the management of anemia in adults with CKD including post kidney transplant.

Rating: Consensus
Conditional

- Risks/Harms of Implementing This Recommendation

  - Oral iron supplementation may result in gastrointestinal distress and lack of adherence to regime
  - Iron absorption may be impaired by other medications, including phosphate binders, other iron and supplements
  - See package insert for risks and harms of iron supplementation
  - Excessive intake of vitamin C may result in hyperoxalosis and contribute to the formation of calcium oxalate kidney stones

- Vomiting or diarrhea over a prolonged period of time may result in increased B-vitamin loss.

- Conditions of Application

  These recommendations apply to individuals with CKD with serum ferritin under 100ng per ml (but not greater than 500ng per ml) and TSAT under 20%.

- Potential Costs Associated with Application

  Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

  - Anemia of CKD is more prevalent at GFR below 60ml per minute as a consequence of loss of erythropoietin synthesis by the kidney. Target goals for treatment are hemoglobin levels of 12g per dL for males and 11g per dL for females (Austrian Multicenter Study Group of r-HuEPO in Predialysis Patients, 1992).
  - One randomized controlled trial in patients with chronic kidney disease without dialysis comparing erythropoietin treatment vs. placebo reported significant improvement in energy levels and work capacity in the treatment group (US Recombinant Human Erythropoietin Predialysis Study Group, 1991)
  - Iron supplementation is necessary for effective erythropoiesis. When there is inadequate response to rHu-EPO, folate and vitamin B_{12} status should also be evaluated (Jungers et al, 2001).
  - There are limited long-term studies of the benefits of rHu-EPO in chronic kidney disease (non-dialysis).

  From the KDOQI Clinical Practice Guidelines for Anemia in Chronic Kidney Disease (2006)

  Guideline II: Clinical Practice Guidelines and Clinical Practice Recommendations for Anemia in Chronic Kidney Disease in Adults

  - CPR 3.2: Using Iron Agents
    - 3.2.3 (Targets of iron therapy): In the opinion of the work group, sufficient iron should be administered to generally maintain the following indices of iron status during ESA treatment
    - 3.2.3.2 (ND-CKD and PD-CKD): Serum ferritin over 100ng per ml and TSAT over 20%
    - 3.2.4 (Upper level of ferritin): In the opinion of the work group, there is insufficient evidence to recommend routine administration of IV iron if serum ferritin level is greater than 500ng per ml. When ferritin level is greater than 500ng per ml, decisions regarding IV iron administration should weigh ESA responsiveness, Hb and TSAT level and the patient's clinical status.
    - 3.2.5 (Route of administration)
      - 3.2.5.2: In the opinion of the work group, the route of iron administration can be either IV or oral in patients with ND-CKD or PD-CKD.
  - CPR 3.3 (Using Pharmacological and Nonpharmacological Adjuvants to ESA Treatment)
    - 3.3.1 (L-Carnitine): In the opinion of the work group, there is insufficient evidence to recommend the use of L-carnitine in the management of anemia in patients with CKD
    - 3.3.2 (Vitamin C): In the opinion of the work group, there is insufficient evidence to recommend the use of vitamin C (ascorbate) in the management of anemia in patients with CKD.

- Recommendation Strength Rationale

  - Conclusion statement received Grade II
  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Anemia in Chronic Kidney Disease
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines.
  - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  What is the evidence regarding anemia in chronic kidney disease?

  - References

    Austrian Multicenter Study Group of r-HuEPO in Predialysis Patients. Effectiveness and safety of recombinant human erythropoietin in predialysis patients. Nephron. 1992; 61:399-403.

    Jungers P, Choukroun G, Oualim Z, Robino C, Nguyen A and Man N. Beneficial influence of recombinanat human erythropoietin therapy on the rate of progression of chronic renal failure in predialysis patients. *Nephrology Dialysis Transplantation* 2001;16:307-312.

    US Recombinant Human Erythropoietin Predialysis Study Group. Double-blind, placebo-controlled study of the therapeutic use of recombinant human erythropoietin for anemia associated with chronic renal failure in

predialysis patients. Am J Kidney Disease. 1991; 18: 50-59.

- References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

  - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
  - Guideline II (Clinical Practice Guidelines and Clinical Practice Recommendations for Anemia in Chronic Kidney Disease in Adults; CPR 3.2 Using Iron Agents): http://www.kidney.org/professionals/kdoqi/guidelines_anemia/cpr32.htm
  - CPR 3.3 (Using Pharmacological and Nonpharmacological Adjuvants to ESA Treatment): http://www.kidney.org/professionals/kdoqi/guidelines_anemia/cpr33.htm.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Management of Hyperglycemia in Diabetes 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Management of Hyperglycemia in Diabetes and CKD

For adults with diabetes and chronic kidney disease (CKD, including post kidney transplant), the registered dietitian (RD) should implement medical nutrition therapy (MNT) for diabetes care to manage hyperglycemia to achieve a target A1C of approximately 7%. Intensive treatment of hyperglycemia, while avoiding hypoglycemia, prevents diabetic kidney disease (DKD) and may slow progression of established kidney disease.

Rating: Strong
Conditional

- Risks/Harms of Implementing This Recommendation

  - As kidney function declines, the half-life of insulin increases and more frequent episodes of hypoglycemia may occur
  - Intensive treatment of hyperglycemia may result in more frequent episodes of hypoglycemia
  - Evaluation of A1C should include assessment of home blood sugar records showing pre- and post-prandial blood sugar excursions, as well as frequency and severity of hypoglycemic episodes
  - In patients with advanced cardiovascular disease, an A1C below 6.5% may be associated with increased mortality risk.

- Conditions of Application

  This recommendation applies to individuals with diabetes and chronic kidney disease, including post kidney transplant.

- Potential Costs Associated with Application

  Although costs of MNT sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

  From the KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease (2007)

  Guideline Two: Management of Hyperglycemia and General Diabetes Care in CKD

  - Hyperglycemia, the defining feature of diabetes, is a fundamental cause of vascular target-organ complications, including kidney disease. Intensive treatment of hyperglycemia prevents DKD and may slow progression of established kidney disease.
  - 2.1: Target Hb_{A1C} for people with diabetes should be below 7.0%, irrespective of the presence or absence of CKD.

- Recommendation Strength Rationale

  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease.
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines.
  - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and

new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  - References
  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - Delahanty LM. Implications of the Diabetes Control and Complications Trial for renal outcomes and medical nutrition therapy. *J Renal Nutr.* 1998; 8: 59-63.
    - Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med.* 1993; 329: 977-986.
    - Irvin B. The progression and treatment of diabetic nephropathy. *Top Clin Nutr.* 1996; 12: 31-40.
    - Pagenkemper JJ. Nutrition management of diabetes in chronic kidney disease. In A Clinical Guide to Nutrition Care in Kidney Disease, edited by Laura Byham-Gray, PhD, RD, CNSD, and Karen Wiesen, MS, RD, *Renal Dietitians Dietetic Practice Group of the American Dietetic Association and the Council on Renal Nutrition of the National Kidney Foundation,* 2004.
    - Pogach LM, Brietzke SA, Cowan CL, Jr et al. Development of evidence-based clinical practice guidelines for diabetes: the Department of Veterans Affairs/Department of Defense guidelines initiative.*Diabetes Care,* 2004; 27 (Suppl 2): B82-B89.
    - The Action to Control Cardiovascular Risk in Diabetes Study Group. Effects of intensive glucose lowering in type 2 diabetes. *New Engl J Med.* 2008; 358: 2, 545-2, 559.
    - The ADVANCE Collaborative Group. Intensive blood glucose control and vascular outcomes in patients with type 2 diabetes. *New Engl J Med.* 2008; 358: 2, 560-2, 572.
    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
    - Guideline 2: Management of Hyperglycemia and General Diabetes Care in CKD: http://www.kidney.org/professionals/kdoqi/guideline_diabetes/guide2.htm.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Multi-Faceted Approach to Intervention in Diabetes 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Multi-Faceted Approach to Intervention in Diabetes and CKD

  For adults with diabetes and chronic kidney disease (CKD, including post kidney transplant), the registered dietitian (RD) should implement Medical Nutrition Therapy (MNT) using a multi-faceted approach, including education and counseling in healthy behaviors, treatment to reduce risk factors and self-management strategies. Multiple risk factors are managed concurrently in adults with diabetes and CKD and the incremental effects of treating each of these risk factors results in substantial clinical benefits.

  Rating: Consensus
  Conditional

  - Risks/Harms of Implementing This Recommendation

    None.

  - Conditions of Application

    This recommendation applies to individuals with diabetes and CKD, including post kidney transplant.

  - Potential Costs Associated with Application

    Although costs of MNT sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

  - Recommendation Narrative

    From the KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease (2007)

    - *CPR Two: Multi-Faceted Approach to Intervention in Diabetes and CKD*

- Multiple risk factors are managed concurrently in patients with diabetes and CKD and the incremental effects of treating each of these risk factors appear to add up to substantial clinical benefits.
    - 2.1: The care of people with diabetes and CKD should incorporate a multi-faceted approach to intervention that includes instruction in healthy behaviors and treatments to reduce risk factors
    - 2.2: Target body mass index (BMI) for people with diabetes and CKD should be within the normal range (18.5kg/m^2 to 24.9kg/m^2).
- *CPR Four: Behavioral Self-Management in Diabetes and CKD*
    - Behavioral self-management in patients with diabetes and CKD is particularly challenging because of the intensive nature of the diabetes regimen. Education alone is not sufficient to promote and sustain healthy behavior change, particularly with such a complex regimen.
        - 4.1: Self-management strategies should be key components of a multi-faceted treatment plan with attention to multiple behaviors
            - Monitoring and treatment of glycemia
            - Blood pressure
            - Nutrition
            - Smoking cessation
            - Exercise
            - Adherence to medicines.

- Recommendation Strength Rationale

    - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease
    - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
    - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines.
    - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

    - References
    - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

        - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
        - Diabetes and Chronic Kidney Disease: http://www.kidney.org/professionals/kdoqi/guideline_diabetes/
        - *CPR 2: Multifaceted Approach to Intervention in Diabetes and CKD:* http://www.kidney.org/professionals/kdoqi/guideline_diabetes/cpr2.htm
        - *CPR 4: Behavioral Self-Management in Diabetes and CKD:* http://www.kidney.org/professionals/kdoqi/guideline_diabetes/cpr4.htm

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Multi-Faceted Approach to Intervention in Dyslipidemias 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Multi-Faceted Approach to Intervention in Dyslipidemias and CKD

  For adults with dyslipidemia and chronic kidney disease (CKD, including post kidney transplant), the registered dietitian (RD) should implement medical nutrition therapy (MNT), using a multi-faceted approach, including education and counseling in therapeutic lifestyle changes (TLC), treatment to reduce risk factors and self-management strategies. Multiple risk factors are managed concurrently in adults with dyslipidemia and CKD and the incremental effects of treating each of these risk factors results in substantial clinical benefits.

  Rating: Fair
  Conditional

- Risks/Harms of Implementing This Recommendation

  None.

- Conditions of Application

  This recommendation applies to individuals with dyslipidemia and CKD, including post kidney transplant.

- Potential Costs Associated with Application

  Although costs of MNT sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

  From the KDOQI Clinical Practice Guidelines for Managing Dyslipidemias in Chronic Kidney Disease (2003)

  - *Guideline Four*
    - 4.1: For adults with Stage Five CKD and fasting triglycerides of at least 500mg per dL (at least 5.65mmol per L) that cannot be corrected by removing an underlying cause, treatment with therapeutic lifestyle changes (TLC) and a triglyceride-lowering agent should be considered
    - 4.2: For adults with Stage Five CKD and LDL at or above 100mg per dL (at least 2.59mmol per L), treatment should be considered to reduce LDL to under 100mg per dL (under 2.59mmol per L)
    - 4.3: For adults with Stage Five CKD and LDL under 100mg per dL (under 2.59 mmol per L), fasting triglycerides at least 200mg per dL (at least 2.26mmol per L) and non-HDL cholesterol (total cholesterol minus HDL) at least 130mg per dL (at least 3.36mmol per L), treatment should be considered to reduce non-HDL cholesterol to below 130mg per dL (under 3.36mmol per L).

  From the KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease (2007)

  - *Guideline Four: Management of Dyslipidemia in Diabetes and CKD*
    - Dyslipidemia is common in people with diabetes and CKD. The risk of CVD is greatly increased in this population. People with diabetes and CKD should be treated according to current guidelines for high-risk groups.
    - 4.1: Target low-density lipoprotein cholesterol (LDL-cholesterol) in people with diabetes and CKD Stages One through Four should be under 100mg per dL; under 70mg per dL is a therapeutic option.

- Recommendation Strength Rationale

  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for:
    - Managing Dyslipidemias in Chronic Kidney Disease
    - Diabetes and Chronic Kidney Disease.
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
  - Please check the KDOQI website (www.kidney.org) and KDIGO ® website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- References
- References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

- Beto J. Which diet for which renal failure: Making sense of the options. *J Am Diet Assoc.* 1995; 95: 898-903.
- Culleton BF, Larson MG, Wilson PWF, Evans JC, Parfrey PS, Levy D. Cardiovascular disease and mortality in a community-based cohort with mild renal insufficiency. *Kidney Int.* 1999; 56: 2, 214-2, 219.
- Fried LF, Orchard TJ, Kasiske BL. Effect of lipid reduction on the progression of renal disease: A meta-analysis. *Kidney Int.* 2001; 59: 260-269.
- Jungers P, Massy ZA, Khoa TN, Fumeron C, Labrunie M, Lacour B, Descamps-Latscha B, Man NK. Incidence and risk factors of atherosclerotic cardiovascular accidents in predialysis chronic renal failure patients: a prospective study. *Nephrol Dial Transplant.* 1997; 12: 2, 597-2, 602.
- Kasiske BL. Hyperlipidemia in patients with chronic renal disease. *Am J Kidney Dis.* 1998; 32 (Suppl 3): S142-S156.
- Muirhead N. The rationale for early management of chronic renal insufficiency. *Nephrol Dial Transplant.* 2001; 16 (suppl 7): 51-56.
- Stenvinkel P, Heimburger O, Paultre F, Diczfalusy U, Wang T, Berglund L, Jogestrand T. Strong association

between malnutrition, inflammation, and atherosclerosis in chronic renal failure. *Kidney Int.* 1999; 55: 1, 899-1, 911.
- National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI
- Managing Dyslipidemias in Chronic Kidney Disease: http://www.kidney.org/professionals/KDOQI/guidelines_lipids/toc.htm
- Guideline Four: http://www.kidney.org/professionals/KDOQI/guidelines_lipids/iii.htm#guide4
- Diabetes and Chronic Kidney Disease: http://www.kidney.org/professionals/kdoqi/guideline_diabetes/
- Guideline Four (Management of Dyslipidemia in Diabetes and CKD): http://www.kidney.org/professionals/kdoqi/guideline_diabetes/guide4.htm.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Education on Self-Management Behaviors 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Education on Self-Management Behaviors

For individuals with chronic kidney disease (CKD, including post kidney transplant), the registered dietitian (RD) should provide education and counseling regarding self-management behaviors. Therapy must take into consideration the patient's perception of the health-care provider's advice and prescriptions, factors that may influence self-management behaviors and the likelihood that the patient will adhere to recommendations.

Rating: Fair
Imperative

- Risks/Harms of Implementing This Recommendation

None.

- Conditions of Application

No conditions specified.

- Potential Costs Associated with Application

Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

From the KDOQI Clinical Practice Guidelines on Hypertension and Antihypertensive Agents in Chronic Kidney Disease (2004)

Guideline Five: Education on Self-Management Behavior

- Anti-hypertensive therapy must take into consideration the patient's perception of the health-care provider's advice and prescriptions, factors that may influence self-management behaviors and the likelihood that the patient will adhere to recommendations.
  - *5.1:* Self-management principles should be incorporated into the treatment plan (B)
  - *5.2:* Patient and family education about anti-hypertensive therapy should be culturally sensitive, sensitive to economic considerations and based on the patient's level of understanding (B)
  - *5.3:* All patients should be assessed for barriers to adherence and self-management (B) and referred for further counseling as needed (to a nurse practitioner, registered nurse, registered dietitian, masters prepared social worker, pharmacist, physician assistant or other professional) (C).

- Recommendation Strength Rationale

- The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines on Hypertension and Antihypertensive Agents in Chronic Kidney Disease
- The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
- During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
- Please check the KDOQI website (www.kidney.org) and KDIGO® website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  - References
  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
    - Hypertension and Anti-Hypertensive Agents in Chronic Kidney Disease: http://www.kidney.org/professionals/KDOQI/guidelines_bp/index.htm
    - Guideline 5 (Education on Self-Management Behavior): http://www.kidney.org/professionals/KDOQI/guidelines_bp/guide_5.htm.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Sodium 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Control Sodium Intake in CKD

  For adults with chronic kidney disease (CKD) including post-kidney transplant, the Registered Dietitian (RD) should recommend/prescribe a sodium intake of less than 2.4g (Stages One to Five), with adjustments based on the following:

  - Blood pressure
  - Medications
  - Kidney function
  - Hydration status
  - Acidosis
  - Glycemic control
  - Catabolism
  - Gastrointestinal issues, including vomiting, diarrhea and constipation.

  Dietary and other therapeutic lifestyle modifications are recommended as part of a comprehensive strategy to reduce cardiovascular disease risk in adults with CKD.

  Rating: Fair
  Imperative

  - Risks/Harms of Implementing This Recommendation

    A nutrition prescription that is too high or too low in sodium may result in adverse outcomes.

  - Conditions of Application

    Current state laws and regulations which define the RD's scope of practice should be checked regarding interpretation of terms such as "write an order, " "order changes, " "initiate, " "recommend, " "prescribe, " etc. Nutrition prescription privileges may be granted to an RD by the governing body of the hospital or other practice settings. The governing body of the hospital or other practice settings via the medical staff bylaws may also designate an RD to receive and implement MD/DO delegated orders or administer disease-specific or condition-specific patient care protocols, as approved and adopted by the facility or institution.

    For more information, members of the American Dietetic Association can access www.eatright.org/quality. Under "Quality Management, " topics include Practice Resources, Regulatory, State Resources, Licensure and Accreditation Organization.

  - Potential Costs Associated with Application

    Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

  - Recommendation Narrative

- Better renal outcomes, as well as lower blood pressure and albuminuria levels, have been shown in twoRCTs and a small observational study among adults, non-dialyzed CKD patients on sodium-restricted diets (alone or in combination with other behavioral intervention and protein restriction), compared with those who do not reduce sodium intakes (Iseki et al, 1996; Yamamoto et al, 1997; Cianciaruso et al, 1998; Mailloux et al, 1998; Imanishi et al, 2001)
- The prescribed sodium restricted diets in the RCTs were targeted to sodium levels of 1, 150mg to 1, 840mg (MDRD study) and 1, 955mg (a small RCT) per day
- Weak observational data also support dietary protein and salt restriction to stabilize renal function in kidney transplant patients (Bernardi et al, 2003; Bernardi et al, 2005).

From the KDOQI Clinical Practice Guidelines on Hypertension and Antihypertensive Agents in Chronic Kidney Disease (2004)

Guideline 6: Dietary and Other Therapeutic Lifestyle Changes in Adults

- Dietary and other therapeutic lifestyle modifications are recommended as part of a comprehensive strategy to lower blood pressure and reduce CVD risk in CKD.
  - 6.1: Dietary sodium intake of less than 2.4g per day (less than 100mmol per day) should be recommended in most adults with CKD and hypertension (A)
  - 6.2: Other dietary recommendations for adults should be modified according to the stage of CKD (B)
  - 6.3: Lifestyle modifications recommended for CVD risk reduction should be recommended as part of the treatment regimen (B)
  - 6.4: Referral to an RD should be considered to help patients achieve dietary recommendations (C).

From the KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease (2007)

Guideline 5: Management of Hyperglycemia and General Diabetes Care in CKD

- Management of diabetes and CKD should include nutritional intervention. Dietary modifications may reduce progression of CKD.
  - 5.1: Target dietary protein intake for people with diabetes and CKD Stages One to Four should be the RDA of 0.8g per kg body weight per day (B).

Table 43. A Balanced Approach to Nutrition in CKD With or Without Diabetes: Macronutrient Composition and Mineral Content

- Recommendation Strength Rationale

  - Conclusion statement received Grade II
  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines on Hypertension and Antihypertensive Agents in Chronic Kidney Disease and the Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines.

  Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  What are the sodium requirements for adult non-dialyzed patients with chronic kidney disease, nephrotic syndrome, diabetic nephropathy and kidney transplant?

  - References

    Bernardi A, Biasia F, Pati T, Piva M, Scaramuzzo P, Stoppa F, Bucciante G. Factors affecting nutritional status, response to exercise and progression of chronic rejection in kidney transplant recipients. *J Renal Nutrition.* 15 (1): 54-57, 205.

    Bernardi A, Biasia F, Pati T, Piva M, D'Angelo A, Bucciante G. Long-term protein intake control in kidney transplant recipients: Effect in kidney graft function and in nutritional status. *Am J Kidney Dis.* 2003; 41(S1): S146-S152.

    Cianciaruso B, Bellizzi V, Minutolo R, Tavera A, Capuano A, Conte G, De Nicola L. Salt intake and renal outcome in patients with progressive renal disease. Miner Electrolyte Metab 1998;24:296-301.

    Imanishi M, Yoshioka K, Okumura M, Konishi Y, Okada N, Morikawa T, Sato T, Tanaka S, Fujii S. Sodium sensitivity related to albuminuria appearaing before hypertension in type 2 diabetic patients. Diabetes Care, 2001; 24 (1): 111-116.

    Iseki K, Uehara H, Nishime K, Tokuyama K, Yoshihara K, Kinjo K, Shiohira Y, Fukiyama K. Impact of the initial levels of laboratory variables on survival in chronic dialysis patients. Am J Kidney Disease. 1996; 28: 541-548.

Mailloux LU, Levey AS. Hypertension in patients with chronic renal disease. Am J Kidney Diseases 1998; 32(Suppl 3): S120-S141.

Yamamoto ME, Olson MB, Fine J, Powers S, Stollar C. The effect of sodium restriction and weight reduction on blood pressure of patients with hypertension and chronic renal disease. *J Renal Nutr.* 1997; 7: 25-32.

- References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process
  - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
  - *Guideline 6: Dietary and Other Therapeutic Lifestyle Changes in Adults:* http://www.kidney.org/professionals/kdoqi/guidelines_bp/guide_6.htm
  - *Guideline 5: Management of Hyperglycemia and General Diabetes Care in CKD:* http://www.kidney.org/professionals/kdoqi/guideline_diabetes/guide5.htm.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Fish Oil/Omega-3 Fatty Acids 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Fish Oil/Omega-3 Fatty Acids

If the use of fish oil or omega-3 fatty acid supplementation is proposed as a method to improve renal function, the registered dietitian (RD) should advise on the conflicting evidence regarding effectiveness of this strategy. Research reports that renal outcomes were inconsistent among patients with IgA nephropathy who received fish oil supplementation. There is insufficient evidence to support fish oil therapy to improve renal function and patient or graft survival for kidney transplant patients. However, evidence does support a benefit of fish oil supplementation in reducing oxidative stress and improving lipid profile in adults with chronic kidney disease (CKD, including post kidney transplant).

Rating: Fair
Conditional

- Risks/Harms of Implementing This Recommendation
  - The dietitian should be aware that fish oil therapy provided at the levels given in the studies can affect the ability of the blood to coagulate and may be additive to the effects of anticoagulant therapy
  - Patient tolerance, adherence or allergies may be factors in maintaining a fish oil supplementation regimen
  - Therapeutic doses of EPA and DHA may vary based on choice of over-the-counter supplements.

- Conditions of Application

  This recommendation applies if fish oil supplementation is proposed as a method to improve renal function.

- Potential Costs Associated with Application
  - Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes
  - The costs of fish oil supplements should be considered.

- Recommendation Narrative
  - Renal outcomes (proteinuria and rate of GFR decline) were inconsistent among patients with IgA nephropathy who received fish oil supplementation
  - One four-year randomized controlled trial indicated a slower decline in renal function and a decrease in proteinuria in patients with IgA nephropathy who received six grams of fish oil (1.43g EPA+DHA) per day, in comparison to the control group (Alexopoulos et al, 2004)
  - Trials of two years' duration or less that prescribed three grams to four grams of fish oil supplements (1.35g to 3.35g EPA+DHA) per day did not report a consistent significant effect on renal outcomes (Donadio, 2001; Branten et al, 2002; Parinyasiri et al, 2004; Sulikowska et al, 2004; Hogg, 2006)
  - In addition, a meta-analysis of five earlier trials suggested similar results (Dillon, 1997)
  - Despite such findings, there were various positive effects on other study parameters (e.g., lipid profiles, homocysteine levels)
  - There is insufficient evidence to support fish oil therapy to improve renal function and patient or graft survival for kidney transplant patients
  - Limited evidence shows potential benefit of fish oil in reducing oxidative stress and improving lipid profiles (Tatsioni et al, 2005; Lim et al, 2007).

- Recommendation Strength Rationale

  Conclusion statements received Grades II and III.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  What are the effects of fish oil therapy on the outcomes of IgA nephropathy?

  What are the effects of fish oil therapy on the outcomes of renal transplant?

  - References

    Alexopoulos E, Sangou M, Pantzaki A, Kirmizis D, Memmos D. Treatment of severe IgA nephropathy with omega-3 fatty acids: The effect of a "very low dose" regimen. *Renal Failure.* 2004; 26: 453-459.

    Branten AJW , Klasen IS , Wetzels JFM. Short-term effects of fish oil treatment on urinary excretion of high- and low-molecular weight proteins in patients with IgA nephropathy. *Clinical Nephrology.* 2002; 58: 267-274.

    Dillon JJ. Fish oil therapy for IgA nephropathy: Efficacy and interstudy variability. *J Am Soc Nephrol.* 1997; 8: 1,739-1,744.

    Donadio JV, Larson TS, Bergstralh EJ, Grande JE. Randomized trial of high-dose compared with low-dose omega-3 fatty acids in severe IgA nephropathy. *J Am Soc Nephrol.* 2001; 12: 791-799.

    Hogg RJ, Lee J, Nardelli N, Julian BA, Cattran D, Waldo B, Wyatt R, Jennette C, Sibley R, Hyland K, Fitzgibbons L, Hirshchman G, Donadio JV, Holub BJ. Clinical trial to evaluate omega-3 fatty acids and alternate day prednisone in patients with IgA nephropathy: Report from the Southwest Pediatric Nephrology Study Group. *Clin J Am Soc Nephrol.* 2006; 1: 467-474.

    Parinyasiri U, Ong-Ajyooth L,Parichatikanond P,Ong-Ajyooth S,Liammongkolkul S, Kanyog S. Effect of fish oil on oxidative stress, lipid profile and renal function in IgA nephropathy. *J Med Assoc Thai.* 2004 Feb; 87(2): 143-149.

    Sulikowska B, Nieweglowski T, Manitius J, Lysiak-Szydlowska W, Rutkowski B. Effects of 12-month therapy with omega-3 polyunsaturated acids on glomerular filtration response to dopamine in IgA nephropathy. *Am J Nephrol.* 2004; 24: 474-482.

    Lim AK, Manley KJ, Roberts MA, Fraenkel MB. Fish oil treatment for kidney transplant recipients: A meta-analysis of randomized controlled trials. *Transplantation.* 2007 Apr 15; 83(7): 831-838.

    Tatsioni A, Chung M, Sun Y, Kupelnick B, Lichtenstein AH, Perrone R, Chew P, Lau J, Bonis PA. Effects of fish oil supplementation on kidney transplantation: A systematic review and meta-analysis of randomized, controlled trials. *J Am Soc Nephrol.* 2005 Aug; 16(8): 2,462-2,470.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Physical Activity 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Physical Activity

  If not contraindicated, the registered dietitian (RD) should encourage adults with chronic kidney disease (CKD, including post kidney transplant), to increase frequency or duration of physical activity as tolerated. Studies report that physical activity may minimize the catabolic effects of protein restriction and improve quality of life.

  Rating: Fair
  Conditional

  - Risks/Harms of Implementing This Recommendation

    - Before beginning a program of physical activity more vigorous than brisk walking, individuals with CKD should be assessed for conditions that might be associated with an increased risk of cardiovascular disease and other physical conditions that may be adversely affected

- Intense physical activity in adults with CKD may contribute to disability or death, thus consultation with a physician prior to beginning an exercise program should be recommended
- Appropriate footwear is essential, especially for patients with neuropathy.

- Conditions of Application

  This recommendation applies to adults with CKD (including post kidney transplant), who have medical clearance to engage in physical activity.

- Potential Costs Associated with Application

  Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

  - Short-term evidence (12 weeks) suggests that resistance exercise training may minimize the catabolic effects of protein restriction in patients over 50 years old with Stage Four to Five chronic kidney disease not on dialysis when consuming a low-protein diet (Castaneda et al, 2001; Castaneda et al, 2004)
  - Limited evidence up to one year also suggests a beneficial effect of low-intensity aerobic exercise on patients' perceived quality of life (Fitts et al, 1999; Pechter et al, 2003)
  - There is currently minimal evidence suggesting that physical activity and exercise have significant effects on kidney function or body composition in patients after kidney transplantation (Cosio-Lima et al, 2006; Juskowa et al, 2006; Van den Ham et al, 2007)
  - One randomized controlled trial in patients with a recent kidney transplant showed that a one-year term of cardiovascular exercise may improve patients' health-related quality of life by decreasing physical limitations (Painter et al, 2002; Painter et al, 2003).

- Recommendation Strength Rationale

  Both conclusion statements received Grade III.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  What are the effects of physical activity interventions on the factors of disease progression and quality of life in patients with chronic kidney diseases?

  What are the effects of physical activity interventions on the factors of disease progression and quality of life in patients with a kidney transplant?

  - References

    Castaneda C, Gordon PL, Uhlin KL, Levey AS, Kehayias JJ, Levey AS, Kehayias JJ, Dwyer JT, Fielding RA, Roubenoff R, Singh MF. Resistance training to counteract the catabolism of a low-protein diet in patients with chronic renal insufficiency. *Ann Intern Med.* 2001; 135 (11): 965-976.

    Castaneda C, Gordon PL, Parker RC, Uhlin KL, Roubenoff R, Levey AS. Resistance training to reduce the malnutrition-inflammation complex syndrome of chronic kidney disease. *Am J Kidney Dis.* 2004; 43 (4): 607-616.

    Fitts SS, Guthrie MR, Blagg CR. Exercise coaching and rehabilitation counseling improve quality of life for predialysis and dialysis patients. *Nephron.* 1999; 82: 115-121.

    Pechter U, Ots M, Mesikepp S, Zilmer K, Kullissaar T, Vihalemm T, Zilmer M, Maaroos J. Beneficial effects of water-based exercise in patients with chronic kidney disease. *Int J Rehabil Res.* 2003; 26 (2): 153-156.

    Cosio-Lima LM, Thompson PD, Reynolds KL, Headley SA, Winter CR, Manos T, Lagasse MA, Todorovich JR, Germain M. The acute effect of aerobic exercise on brachial artery endothelial function in renal transplant recipients. *Prev Cardiol.* 2006; 9 (4): 211-214.

    Juskowa J, Lewandowska M, Bartlomiejczyk I, Foroncewicz B, Korabiewska I, Miewszas M, Sierdzinski J. Physical Rehabilitation and Risk of Atherosclerosis After Successful Kidney Transplantation. *Transplantation Proceedings.* 2006; 38: 157-160.

    Painter PL, Hector L, Ray K, Lynes L, Dibble S, Paul SM, Tomlanovich SL, Ascher N. A randomized trial of exercise training after renal transplantation. *Transplantation.* 2002; 74 (1): 42-48.

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- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Coordination of Care 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

CKD: Coordination of Care

For adults with chronic kidney disease (CKD, including post kidney transplant), the Registered Dietitian (RD) should implement Medical Nutrition Therapy (MNT) and coordinate care with an interdisciplinary team, through:

- Requesting appropriate data (biochemical and other)
- Communicating with referring provider
- Indicating specific areas of concern or needed reinforcement.

This approach is necessary to effectively integrate MNT into overall management for patients with CKD.

Rating: Consensus
Imperative

- Risks/Harms of Implementing This Recommendation

None.

- Conditions of Application

No conditions specified.

- Potential Costs Associated with Application

Although costs of MNT sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

Subsequent to the publication of the guideline reference below, terminology has been updated.

From the KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure (2000)

- *Guideline 26: Intensive Nutritional Counseling for Chronic Renal Failure (CRF)*
  - The nutritional status of individuals with CRF should be monitored at regular intervals (Evidence)
  - A spontaneous reduction in dietary protein intake (DPI) and a progressive decline in indices of nutritional status occur in many non-dialyzed patients with CRF
  - The presence of protein-energy malnutrition at the initiation of maintenance dialysis is predictive of future mortality risk
  - Interventions that maintain or improve nutritional status during progressive renal failure are likely to be associated with improved long-term survival after commencement of maintenance dialysis
  - Because evidence of protein-energy malnutrition may develop before individuals require renal replacement therapy, regular monitoring (e.g., at one- to three-month intervals) of the patient's nutritional status should be a routine component of the care for the patient with CRF
  - Nutritional status should be assessed more frequently if there is inadequate nutrient intake, frank protein-energy malnutrition or the presence of an illness that may worsen nutritional status.
- *Appendix IV: Role of the Renal Dietitian*
  - Implicit in many of the guidelines in this document is the availability to the patient of an individual with expertise in renal dietetics
  - Implementation of many of the guidelines concerning nutritional assessment (anthropometry, subjective global assessment, dietary interviews and diaries and integration of the results of nutritional measurements) and nutritional therapy (developing a plan for nutritional management, counseling the patient and his or her family on appropriate dietary protein and energy intake, monitoring nutrient intake, educational activities and encouragement to maximize dietary compliance) is best performed by an individual who is trained and experienced in these tasks
  - Although occasionally a physician, nurse or other individual may possess the expertise and time to conduct such activities, a registered dietitian, trained and experienced in renal nutrition, usually is best qualified to carry out these tasks.

- Recommendation Strength Rationale

  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure.
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines.

Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new

publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  - References
  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
    - *Guideline 26 [Intensive Nutritional Counseling for Chronic Renal Failure (CRF)]:* http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_a26.html
    - *Appendix IV (Role of the Renal Dietitian):* http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_appx04a.html.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Multivitamin Supplementation 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Multivitamin Supplementation

  In adults with chronic kidney disease (CKD, including post- kidney transplant), with no known nutrient deficiency (biochemical or physical) and who may be at higher nutritional risk due to poor dietary intake and decreasing GFR, the registered dietitian (RD) should recommend or prescribe a multivitamin preparation. Sufficient vitamin supplementation should be recommended to maintain indices of adequate nutritional status.

  Rating: Consensus
  Conditional

  - Risks/Harms of Implementing This Recommendation

    - Intakes above 100% of the DRI for an individual may result in adverse effects
    - The RD should be aware of fortified foods and nutrient-enhanced products
    - If biochemical indices such as potassium or phosphorus are elevated, multivitamin formulations with minimal or no levels of these nutrients should be recommended. Specific renal formulations may be considered.
    - Sub-clinical nutrient deficiencies take years to manifest before they may become clinically evident.

  - Conditions of Application

    - This recommendation applies to adults with CKD (including post-kidney transplant), with no known nutrient deficiency (biochemical or physical) and who may be at higher nutritional risk due to poor dietary intake and decreasing GFR
    - Current state laws and regulations which define the RD's scope of practice should be checked regarding interpretation of terms such as "write an order, " "order changes, " "initiate, " "recommend, " "prescribe, " etc. Nutrition prescription privileges may be granted to an RD by the governing body of the hospital or other practice settings. The governing body of the hospital or other practice settings, via the medical staff bylaws, may also designate an RD to receive and implement MD- or DO-delegated orders or administer disease-specific or condition-specific patient care protocols, as approved and adopted by the facility or institution.
    - For more information, members of the American Dietetic Association can access www.eatright.org/quality. Under "Quality Management, " topics include Practice Resources, Regulatory, State Resources, Licensure and Accreditation Organization.

  - Potential Costs Associated with Application

    - Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes
    - Inappropriate vitamin supplementation may be costly.

- Recommendation Narrative
  - No study examines the effects of micronutrients on preserving kidney function among adult non-dialyzed patients with CKD, nephrotic syndrome, diabetic nephropathy or kidney transplant
  - Limited evidence suggests that vitamin and mineral supplementation may be needed for ameliorating comorbidities, such as osteoporosis and dyslipidemia among patients with a kidney transplant (Wilcken et al, 1981; Caravaca et al, 1998; Teplan et al, 2003; Sezer et al, 2005).

From the KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease (2003)

Guideline 7: Prevention and Treatment of Vitamin D Insufficiency and Vitamin D Deficiency in CKD Patients

- In CKD patients (Stages Three and Four)
  - 7.2: If the serum level of 25-hydroxyvitamin D is less than 30ng per ml (75mmol per L), supplementation with vitamin D_2 (ergocalciferol) should be initiated (Opinion)
  - 7.3: Following initiation of vitamin D therapy:
    - 7.3a: The use of ergocalciferol therapy should be integrated with the serum calcium and phosphorus
    - 7.3b: The serum levels of corrected total calcium and phosphorus should be measured at least every three months (Opinion)
    - 7.3c: If the serum levels of corrected total calcium exceeds 10.2mg per dL (2.54mmol per L), discontinue ergocalciferol therapy and all forms of vitamin D therapy (Opinion)
    - 7.3d: If the serum phosphorus exceeds 4.6mg per dL (1.49mmol per L), add or increase the dose of phosphate binder. If hyperphosphatemia persists, discontinue vitamin D therapy. (Opinion)
    - 7.3e: Once patients are replete with Vitamin D, continued supplementation with a Vitamin D-containing multivitamin preparation should be used with annual reassessment of serum levels of 25-hydroxyvitamin D and the continued assessment of corrected total calcium and phosphorus every three months (Opinion).

Guideline 8: Vitamin D Therapy in CKD Patients

- Guideline 8A: Active Vitamin D Therapy in Patients with Stages Three and Four CKD
  - 8A.1: In patients with CKD Stages Three and Four, therapy with an active oral vitamin D sterol (calcitriol, alfacalcidol, or doxecalciferol) is indicated when serum levels of 25(OH)-vitamin D are more than 30ng per ml (75nmol per L) and plasma levels of intact PTH are above the target range for the CKD stage (Evidence)
    - 8A.1a: Treatment with an active vitamin D sterol should be undertaken only in patients with serum levels of corrected total calcium lower than 9.5mg per dL (2.37mmol per L) and serum phosphorus lower than 4.6mg per dL (1.49mmol per L) (Opinion)
    - 8A.1b: Vitamin D sterols should not be prescribed for patients with rapidly worsening kidney function or those who are non-compliant with medications or follow-up (Opinion).
  - 8A.2: During therapy with vitamin D sterols, serum levels of calcium and phosphorus should be monitored at least every month after initiation of therapy for the first three months, then every month thereafter. Plasma PTH levels should be measured at least every three months for six months and every three months thereafter (Opinion)
  - 8A.3 Dosage adjustments for patients receiving active vitamin D sterol therapy should be made as follows:
    - 8A.3a: If plasma levels of intact PTH fall below the target range for the CKD stage, hold active vitamin D sterol therapy until plasma levels of intact PTH rise to above the target range, then resume treatment with the dose of active vitamin D sterol reduced by half. If the lowest daily dose of the active vitamin D sterol is being used, reduce to alternate-day dosing (Opinion).
    - 8A.3b: If serum levels of corrected total calcium exceed 9.5mg per dL (2.37mmol per L), hold active vitamin D sterol therapy until serum calcium returns to less than 9.5mg per dL (2.37mmol per L), then resume treatment at half the previous dose. If the lowest daily dose of the active vitamin D sterol is being used, reduce to alternate-day dosing (Opinion).
    - 8A.3c: If serum levels of phosphorus rise to more than 4.6mg per dL (1.49mmol per L), hold active vitamin D therapy, initiate or increase dose of phosphate binder until the levels of serum phosphorus fall to less than 4.6mg per dL (1.49mmol per L), then resume the prior dose of active vitamin D sterol (Opinion).

Guideline 13: Treatment of Bone Disease in CKD

- Guideline 13B: Osteomalacia
  - 13B.3: Osteomalacia due to vitamin D_2 or D_3 deficiency or phosphate depletion, though uncommon, should be treated with vitamin D_2 or D_3 supplementation and phosphate administration, respectively (Opinion)
    - 13B.3a: If osteomalacia due to vitamin D deficiency fails to respond to ergocalciferol or cholecalciferol, particularly in patients with kidney failure (Stage Five), treatment with an active vitamin D sterol may be given (Opinion)
    - 13B.3b: Doses of phosphate supplementation should be adjusted upwards until normal serum levels of phosphorus are achieved (Opinion).

- Recommendation Strength Rationale
  - Conclusion statement received Grade III
  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines

- Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  What are micronutrient needs for adult non-dialyzed patients with chronic kidney disease, nephrotic syndrome, diabetic nephropathy or kidney transplant?

  - References

    Caravaca F, Fernandez MA, Ruiz-Calero R, Cubero J, Aparicio A, Jimenez F, Garcia MC. Effects of oral phosphorus supplementation on mineral metabolism of renal transplant recipients. *Nephrol Dial Transplant.* 1998; 13: 2,605-2,611.

    Sezer S, Uyar M, Arat Z, Ozdemir FN, Haberal M. Potential effects of 1,25-dihydroxyvitamin D3 in renal transplant recipients. *Transplantation Proceedings.* 2005 Sept; 37(7): 3,109-3,111.

    Teplan V, Schuck O, Stollova M, Vitko S. Obesity and hyperhomocysteinuria after kidney transplantation. *Nephrol Dial Transplant*. 2003; 18(suppl 5): 71-73.

    Wilcken DEL, Gupta VJ, Betts AK. Homocysteinein the plasma of renal transplant recipients: effects of cofactors for methionine metabolism. *Clin Sci.* 1981; 61: 743-749.

  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
    - Guideline 7: Prevention and Treatment of Vitamin D Insufficiency and Vitamin D Deficiency in CKD Patients: http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide7.htm
    - Guideline 8: Vitamin D Therapy in CKD Patients: http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide8A.htm
    - Guideline 13: Treatment of Bone Disease in CKD: http://www.kidney.org/professionals/kdoqi/guidelines_bone/Guide13B.htm.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Quick Links

Recommendations Summary

CKD: Potassium 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Control Potassium Intake in CKD

  For adults with chronic kidney disease (CKD), including post kidney transplant who exhibit hyperkalemia, the registered dietitian (RD) should recommend or prescribe a potassium intake of less than 2.4g (Stages Three to Five), with adjustments based on the following:

  - Serum potassium level
  - Blood pressure
  - Medications
  - Kidney function
  - Hydration status
  - Acidosis
  - Glycemic control
  - Catabolism
  - Gastrointestinal (GI) issues, including vomiting, diarrhea, constipation and GI bleed.

  Dietary and other therapeutic lifestyle modifications are recommended as part of a comprehensive strategy to reduce cardiovascular disease risk in adults with CKD. The degree of hypokalemia or hyperkalemia can have a direct effect on cardiac function, with potential for cardiac arrhythmia and sudden death.

  Rating: Fair
  Conditional

  - Risks/Harms of Implementing This Recommendation

- A nutrition prescription that is too high or too low in potassium may result in adverse outcomes
- The RD should use clinical judgment in applying a potassium-controlled diet in patients exhibiting hyperkalemia or hypokalemia secondary to level of kidney function, considering type of diuretic used, type of anithypertensive drug used or other drugs, supplements, food or non-food items, with potential to cause potassium retention or potassium loss.

- Conditions of Application

  - Potassium intake recommendations apply to adults with CKD in Stages Three to Five, including post kidney transplant, who exhibit hyperkalemia
  - Current state laws and regulations which define the RD's scope of practice should be checked regarding interpretation of terms such as "write an order, " "order changes, " "initiate, " "recommend, " "prescribe, " etc. Nutrition prescription privileges may be granted to an RD by the governing body of the hospital or other practice settings. The governing body of the hospital or other practice settings via the medical staff bylaws may also designate an RD to receive and implement MD- OR DO-delegated orders or administer disease-specific or condition-specific patient care protocol(s), as approved and adopted by the facility or institution.
  - For more information, members of the American Dietetic Association can access www.eatright.org/quality. Under "Quality Management, " topics include Practice Resources, Regulatory, State Resources, Licensure and Accreditation Organization.

- Potential Costs Associated with Application

  - Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

- Recommendation Narrative

The prevalence of hypertension and hyperlipidemia with risk for cardiovascular disease, coronary artery disease and left ventricular hypertrophy is higher in CKD, compared to the general population. Serum potassium should be monitored because of the effect of some antihypertensive agents on potassium excretion (Iseki et al, 1996; Bakris et al, 2000).

From the KDOQI Clinical Practice Guidelines on Hypertension and Antihypertensive Agents in Chronic Kidney Disease (2004)

Guideline 6: Dietary and Other Therapeutic Lifestyle Changes in Adults

Dietary and other therapeutic lifestyle modifications are recommended as part of a comprehensive strategy to lower blood pressure and reduce CVD risk in CKD.

- *6.2:* Other dietary recommendations for adults should be modified according to the stage of CKD (B)
- *6.3:* Lifestyle modifications recommended for CVD risk reduction should be recommended as part of the treatment regimen (B)
- *6.4:* Referral to a registered dietitian should be considered to help patients achieve dietary recommendations (C).

From the KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease (2007)

Guideline 5: Management of Hyperglycemia and General Diabetes Care in CKD

Management of diabetes and CKD should include nutritional intervention. Dietary modifications may reduce progression of CKD.

5.1: Target dietary protein intake for people with diabetes and CKD Stages One to Four should be RDA of 0.8g per kg body weight per day (B).

Table 43. A Balanced Approach to Nutrition in CKD With or Without Diabetes: Macronutrient Composition and Mineral Content

- Recommendation Strength Rationale

  - Conclusion statement received Grade II
  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines on Hypertension and Antihypertensive Agents in Chronic Kidney Disease and the Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
  - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  What is the evidence regarding potassium in chronic kidney disease?

  - References

    Bakris GL, Siomos M, Richardson D, Janssen I, Bolton WK, Hebert L, Agarwal R, Catanzaro D. ACE inhibition or angiotensin receptor blockade: Impact on potassium in renal failure. Kidney Int 2000; 58:2084-2092.

    Iseki K, Uehara H, Nishime K, Tokuyama K, Yoshihara K, Kinjo K, Shiohira Y, Fukiyama K. Impact of the initial levels of laboratory variables on survival in chronic dialysis patients. Am J Kidney Disease. 1996; 28: 541-548.

  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
    - Guideline 6 (Dietary and Other Therapeutic Lifestyle Changes in Adults): http://www.kidney.org/professionals/kdoqi/guidelines_bp/guide_6.htm
    - Guideline 5 (Management of Hyperglycemia and General Diabetes Care in CKD): http://www.kidney.org/professionals/kdoqi/guideline_diabetes/guide5.htm.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Monitor and Evaluate Biochemical Parameters 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Monitor and Evaluate Biochemical Parameters

  The registered dietitian (RD) should monitor and evaluate various biochemical parameters in adults with chronic kidney disease (CKD, including post-kidney transplant), related to:

  - Glycemic control
  - Protein-energy malnutrition
  - Inflammation
  - Kidney function
  - Mineral and bone disorders
  - Anemia
  - Dyslipidemia
  - Electrolyte disorders
  - Others as appropriate.

  For list of biochemical parameters, click here.

  Monitoring and evaluation of the above factors is needed to determine the effectiveness of Medical Nutrition Therapy (MNT) in adults with CKD and post kidney transplant.

  Rating: Consensus
  Imperative

  - Risks/Harms of Implementing This Recommendation

    Hydration status and impact of medications should be considered when monitoring and evaluating biochemical parameters.

  - Conditions of Application

    No conditions specified.

  - Potential Costs Associated with Application

    - Although costs of MNT sessions and reimbursement vary, MNT sessions are essential for improved outcomes
    - Accessibility and costs of biochemical parameter testing should be considered.

  - Recommendation Narrative

    Subsequent to the publication of the guideline reference below, terminology has been updated.

    From the KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure (2000)

Guideline 23: Panels of Nutrition Measures for Nondialyzed Patients

- For individuals with CRF (GFR less than 20ml per minute) protein-energy nutritional status should be evaluated by serial measurements of a panel of markers including at least one value from each of the following clusters:
    1. Serum albumin
    2. Edema-free actual body weight, percent standard (NHANES II) body weight, or subjective global assessment (SGA)
    3. Normalized protein nitrogen appearance (nPNA) or dietary interviews and diaries (Evidence and Opinion).

From the KDOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease (2003)

Guideline 1: Evaluation of Calcium and Phosphorus Metabolism

- 1.1: Serum levels of calcium, phosphorus and intact plasma parathyroid hormone (PTH) should be measured in all patients with CKD and GFR less than 60ml per minute per 1.73m^2 (Evidence). The frequency of these measurements should be based on the stage of chronic kidney disease (Opinion).
- 1.2: These measurements should be made more frequently if the patient is receiving concomitant therapy for the abnormalities in the serum levels of calcium, phosphorus or PTH, as detailed in Guidelines 4, 5, 7 and 8 and in transplant recipient, Guideline 16.

Guideline 6: Serum Calcium and Calcium-Phosphorus Product

- In CKD Patients (Stages 3 and 4)
    - 6.1: The serum levels of corrected total calcium should be maintained within the normal range for the laboratory used (Evidence).
- In CKD Patients (Stages 3 to 5)
    - 6.5: The serum calcium-phosphorus product should be maintained at less than 55mg^2 per dL^2 (Evidence). This is best achieved by controlling serum levels of phosphorus within the target range (Opinion).

Guideline 7: Prevention and Treatment of Vitamin D Insufficiency and Vitamin D Deficiency in CKD Patients

- In CKD Patients (Stages 3 and 4)
    - 7.1: If plasma intact PTH is above the target range for the stage of CKD, serum 25-hydroxyvitamin D should be measured at first encounter. If it is normal, repeat annually (Evidence).

Guideline 15: Metabolic Acidosis

- 15.1: In CKD Stages 3, 4 and 5, the serum level of total CO_2 should be measured.

Guideline 16: Bone Disease in the Kidney Transplant Recipient

- 16.1: Serum levels of calcium, phosphorus, total CO_2 and plasma intact PTH should be monitored following kidney transplantation (Opinion)
- 16.5: Treatment of disturbances in bone and mineral metabolism is determined by the level of kidney function in the transplant recipient as provided in Guidelines 1 through 15 for CKD patients (Opinion).

From the KDOQI Clinical Practice Guidelines for Anemia in Chronic Kidney Disease (2006)

Guideline II: Clinical Practice Guidelines and Clinical Practice Recommendations for Anemia in Chronic Kidney Disease in Adults

- CPR 1.1: Identifying Patients and Initiating Evaluation
    - 1.1.1 (Stage and cause of CKD): In the opinion of the Work Group, Hb testing should be carried out in all patients with CKD, regardless of stage or cause.
    - 1.1.3 (Diagnosis of anemia): In the opinion of the Work Group, diagnosis of anemia should be made and further evaluation should be undertaken at the following Hb concentrations: Less than 13.5g per dL in adult males; less than 12.0g per dL in adult females.
- CPR 1.2: Evaluation of Anemia in CKD
    - 1.2.1: In the opinion of the Work Group, initial assessment of anemia should include the following tests:
        - 1.2.1.1: A complete blood count (CBC) including, in addition to the Hb concentration, red blood cell indices [mean corpuscular hemoglobin (MCH), mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), white blood cell count and differential and platelet count]
        - 1.2.1.2: Absolute reticulocyte count
        - 1.2.1.3: Serum ferritin to assess iron stores
        - 1.2.1.4: Serum TSAT or content of Hb in reticulocytes (CHr) to assess adequacy of iron for erythropoiesis.

- Recommendation Strength Rationale

    - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for:
        - Nutrition in Chronic Renal Failure
        - Bone Metabolism and Disease in Chronic Kidney Disease
        - Anemia in Chronic Kidney Disease.
    - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
    - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
    - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  - References
  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
    - Nutrition in Chronic Renal Failure: http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_a23.html
    - Bone Metabolism and Disease in Chronic Kidney Disease: http://www.kidney.org/professionals/kdoqi/guidelines_bone/index.htm
    - Anemia in Chronic Kidney Disease: http://www.kidney.org/professionals/kdoqi/guidelines_anemia/index.htm.

- Chronic Kidney Disease
- Chronic Kidney Disease (CKD) Guideline (2010)

Recommendations Summary

CKD: Monitor and Evaluate Adherence to Nutrition and Lifestyle 2010

Click here to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the Supporting Evidence Section below.

- Recommendation(s)

  CKD: Monitor and Evaluate Adherence to Nutrition and Lifestyle Recommendations

  The registered dietitian (RD) should monitor the following in adults with chronic kidney disease (CKD, including post kidney transplant):

  - Food and nutrient intake (e.g., diet history, diet experience and intake of macronutrients and micronutrients, such as energy, protein, sodium, potassium, calcium, phosphorus and others, as appropriate)
  - Medication (prescription and over-the-counter), dietary supplements (vitamin, minerals, protein, etc.), herbal or botanical supplement use
  - Knowledge, beliefs or attitudes (e.g., readiness to change nutrition and lifestyle behaviors)
  - Behavior
  - Factors affecting access to food and food- and nutrition-related supplies (e.g., safe food and meal availability).

  Monitoring and evaluation of the above factors is needed to determine the effectiveness of Medical Nutrition Therapy (MNT) in adults with CKD and post kidney transplant.

  Rating: Consensus
  Imperative

  - Risks/Harms of Implementing This Recommendation

    None.

  - Conditions of Application

    No conditions specified.

  - Potential Costs Associated with Application

    Although costs of medical nutrition therapy (MNT) sessions and reimbursement vary, MNT sessions are essential for improved outcomes.

  - Recommendation Narrative

    Subsequent to the publication of the guideline reference below, terminology has been updated.

    From the KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure (2000)

    - *Guideline 23: Panels of Nutrition Measures for Non-Dialyzed Patients*
      - For individuals with CRF (GFR under 20ml per minute), protein-energy nutritional status should be evaluated by serial measurements of a panel of markers, including at least one value from each of

the following clusters:

1. Serum albumin
2. Edema-free actual body weight, percentage standard (NHANES II) body weight or subjective global assessment (SGA)
3. Normalized protein nitrogen appearance (nPNA) or dietary interviews and diaries (evidence and opinion).

- *Appendix III: Dietary Interviews and Diaries*
  - There are several methods for estimating dietary nutrient intake. The most common methods are food intake records and dietary recalls. The dietary recall (usually obtained for the previous 24 hours) is a simple, rapid method of obtaining a crude assessment of dietary intake. It can be performed in approximately 30 minutes, does not require the patient to keep records and relies on the patient's ability to remember how much food was eaten during the previous 24 hours. Accurate quantification of the amounts of foods eaten is critical for the 24-hour recall. Various models of foods and measuring devices are used to estimate portion sizes. Advantages to the recall method are that respondents usually will not be able to modify their eating behavior in anticipation of a dietary evaluation and they do not have to be literate. Disadvantages of the 24-hour recall include its reliance on memory (which may be particularly limiting in the elderly), that the responses may be less accurate or unrepresentative of typical intakes and that it must be obtained by a trained and skilled dietitian.
  - Dietary diaries are written reports of foods eaten during a specified length of time. A food-intake record, lasting for several (three to seven) days, provides a more reliable estimate of an individual's nutrient intake than do single-day records. Records kept for more than three days increase the likelihood of inaccurate reporting because an individual's motivation has been shown to decrease with increasing number of days of dietary data collection, especially if the days are consecutive. On the other hand, records maintained for shorter times may not provide accurate data on usual food and nutrient intakes. The actual number of days chosen to collect food records should depend on the degree of accuracy needed, the day-to-day variability in the intake of the nutrient being measured and the cooperation of the patient.
  - The validity and reliability of the dietary interviews and diaries depend on the patient's ability to provide accurate data and the ability of the nutritionist to conduct detailed, probing interviews. The intake of nutrients is generally calculated using computer-based programs. Food records must be maintained meticulously to maximize the accuracy of the diary. Food intake should be recorded at the time the food is eaten to minimize reliance on memory. Special data collection forms and instructions are provided to assist the individual to record adequate detail. Recording error can be minimized if instructions and proper directions on how to approximate portion sizes and servings of fluid are provided.
  - Food models are also helpful for instruction. The food record should indicate the time of day of any intake (both meals and snacks), the names of foods eaten, the approximate amount ingested, the method of preparation and special recipes or steps taken in the food preparation. The dietitian should carefully review the food record with the patient for accuracy and completeness shortly after it is completed.

- Recommendation Strength Rationale

  - The ADA CKD Expert Work Group concurs with the National Kidney Foundation KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure
  - The National Kidney Foundation Kidney Disease Outcome Quality Initiative (NKF KDOQI™) evidence analysis process began in 1995 and it has evolved since that time. ADA recommendations were graded when based on more recent KDOQI guidelines since they were developed using methods of evidence analysis that are comparable to the ADA evidence analysis process. Many KDOQI guidelines were supported by expert opinion and therefore were graded as Consensus by the ADA CKD Expert Work Group.
  - During the development of these guidelines, Kidney Disease: Improving Global Outcomes (KDIGO®) international evidence-based guidelines were also under development and will be incorporated into future revision of these guidelines
  - Please check the KDOQI website (www.kidney.org) and KDIGO website (www.kdigo.org) for updates and new publications.

- Minority Opinions

  Consensus reached.

- Supporting Evidence

  The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

  - References
  - References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process

    - National Kidney Foundation KDOQI Clinical Practice Guidelines are accessible at the following link: http://www.kidney.org/professionals/KDOQI/
    - Guideline 23: Panels of Nutrition Measures for Nondialyzed Patients: http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_a23.html
    - Appendix III: Dietary Interviews and Diaries: http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_appx03a.html.