

Optimising Nutritional Care to Improve Clinical Outcomes in Individuals with Chronic Kidney Disease

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Abstract

Chronic kidney disease (CKD) is a progressive disorder characterized by the gradual loss of kidney function, leading to disturbances in fluid balance, electrolyte homeostasis, and metabolic regulation. Nutritional management has emerged as a fundamental component of CKD care, complementing pharmacological treatment and lifestyle modifications to improve patient outcomes. Appropriate dietary interventions can help delay disease progression, reduce metabolic complications, and enhance quality of life across all stages of CKD.

This review aims to examine the significance of individualized nutritional management in patients with chronic kidney disease, with particular emphasis on the regulation of essential nutrients, the role of medical nutrition therapy, and the contribution of multidisciplinary care in optimizing renal health.

A comprehensive narrative review was conducted by evaluating current evidence from peer-reviewed clinical studies, international nephrology guidelines, and nutrition recommendations related to chronic kidney disease. The review focuses on dietary modifications involving protein, sodium, potassium, phosphorus, calcium, and energy intake, as well as the clinical role of renal dietitians in patient-centered nutritional care.

Current evidence demonstrates that individualized nutrition therapy plays a significant role in preserving kidney function, controlling electrolyte and mineral imbalances, reducing cardiovascular risk, and preventing protein-energy wasting. Dietary interventions tailored according to disease stage, laboratory findings, and comorbid conditions improve metabolic stability, enhance treatment adherence, and contribute to better clinical outcomes. Collaboration between nephrologists and renal dietitians further strengthens the effectiveness of nutritional management by providing personalized dietary counseling and continuous nutritional monitoring.

Nutrition is a cornerstone of comprehensive chronic kidney disease management. Personalized dietary strategies integrated with routine medical care offer substantial benefits in slowing disease progression, minimizing complications, and improving patients' quality of life. Future research should focus on precision nutrition approaches and long-term clinical outcomes to optimise dietary interventions for individuals with CKD further.

Keywords: Chronic kidney disease, Medical nutrition therapy, Renal nutrition, Dietary management, Protein intake, Sodium restriction, Potassium management, Phosphorus control, Renal dietitian, Electrolyte balance, Kidney function, Quality of life.

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Introduction

Nutrition plays a central role in the prevention, treatment, and long-term management of chronic kidney disease (CKD). As kidney function gradually declines, the body's ability to regulate water, electrolytes, and metabolic waste products becomes impaired, increasing the risk of nutritional imbalances and disease-related complications (1). Appropriate dietary management helps preserve residual kidney function, reduce metabolic disturbances, minimize cardiovascular risk, and improve patients' overall quality of life. A well-balanced diet that provides adequate energy, high-quality protein, essential vitamins, minerals, and healthy fats is fundamental to maintaining nutritional status while preventing excessive accumulation of waste products. Alongside regular physical activity, medication adherence, and routine clinical monitoring, individualized nutrition therapy has become an essential component of comprehensive CKD care (2).

Unlike standardized dietary recommendations for healthy individuals, nutritional management in CKD must be tailored according to disease stage, estimated glomerular filtration rate (eGFR), presence of diabetes or hypertension, body composition, laboratory findings, and treatment modality such as conservative management, dialysis, or kidney transplantation (3). Dietary requirements may change as renal function declines or when additional medical conditions develop. Consequently, continuous nutritional assessment and periodic modification of dietary plans are necessary to ensure optimal metabolic control while preventing malnutrition, protein-energy wasting, and electrolyte abnormalities. Personalized nutrition therefore represents one of the most effective non-pharmacological interventions for slowing CKD progression and enhancing patient outcomes (4).

Individualized Dietary Modifications and the Role of Renal Dietitians

As kidney disease progresses, dietary adjustments become increasingly important to compensate for the kidneys' reduced ability to maintain electrolyte balance and eliminate metabolic waste. Nutritional interventions are designed not only to protect remaining kidney function but also to control associated complications such as hypertension, edema, metabolic acidosis, mineral bone disorders, anemia, and cardiovascular disease (5). Since every patient presents with unique clinical characteristics, dietary prescriptions should be individualized rather than universally applied. Patients with coexisting conditions such as diabetes mellitus or cardiovascular disease require integrated nutritional strategies that simultaneously address glycemic control, lipid management, blood pressure regulation, and renal protection (6).

Registered renal dietitians are integral members of the multidisciplinary CKD care team. Through comprehensive nutritional assessments, they evaluate dietary habits, anthropometric measurements, biochemical parameters, and lifestyle factors to develop evidence-based nutrition plans. Dietitians educate patients about appropriate food selection, portion control, meal planning, food preparation techniques,

and interpretation of nutrition labels (7). They also assist patients in adapting traditional dietary preferences while maintaining nutritional adequacy and therapeutic goals. Regular dietary counseling improves treatment adherence, promotes healthy eating behaviors, and reduces the likelihood of nutritional deficiencies or excessive dietary restrictions. Numerous clinical studies have demonstrated that early involvement of renal dietitians is associated with improved metabolic control, delayed disease progression, fewer hospitalizations, and enhanced quality of life among individuals with CKD (8).

Nutritional Components Requiring Careful Management in Chronic Kidney Disease

Effective nutritional therapy in CKD focuses on regulating several key nutrients whose metabolism becomes altered as renal function deteriorates. Sodium intake should be carefully controlled because excessive consumption promotes fluid retention, hypertension, edema, and increased cardiovascular burden (9). Restricting dietary sodium enhances blood pressure control and improves the effectiveness of antihypertensive medications while reducing proteinuria and slowing disease progression. Patients are encouraged to minimize processed foods, canned products, packaged snacks, and commercially prepared meals that often contain hidden sodium. Instead, herbs, spices, citrus juice, and sodium-free seasonings can improve flavor without increasing sodium intake (10).

Protein intake requires careful balancing in CKD. While adequate protein is essential for preserving muscle mass, immune function, and tissue repair, excessive protein consumption increases nitrogenous waste production and may accelerate renal workload in patients with non-dialysis CKD. Current nutritional guidelines recommend individualized protein prescriptions based on disease stage and nutritional status (11). Patients receiving dialysis generally require higher protein intake to compensate for amino acid losses during treatment, whereas individuals with earlier stages of CKD may benefit from moderate protein restriction under professional supervision. Adequate caloric intake remains equally important because insufficient energy consumption may lead to muscle protein breakdown and protein-energy wasting, a significant predictor of morbidity and mortality in CKD (12).

Calcium and phosphorus metabolism are frequently disrupted as kidney disease advances. Reduced phosphate excretion leads to hyperphosphatemia, secondary hyperparathyroidism, vascular calcification, and chronic kidney disease-mineral and bone disorder (CKD-MBD) (13). Patients are often advised to limit foods rich in inorganic phosphorus, particularly processed foods containing phosphate additives, while maintaining appropriate calcium intake through individualized dietary recommendations or supplementation when clinically indicated. Maintaining balanced calcium-phosphorus homeostasis helps preserve bone integrity and reduces cardiovascular complications associated with advanced CKD (14).

Potassium Regulation and Electrolyte Balance

Potassium is an essential intracellular electrolyte involved in neuromuscular transmission, cardiac rhythm regulation, and muscle contraction. Healthy kidneys maintain potassium homeostasis by adjusting urinary potassium excretion according to dietary intake (19). However, declining renal function significantly reduces potassium elimination, increasing the risk of hyperkalemia, a potentially life-threatening condition associated with cardiac arrhythmias and sudden cardiac death. Conversely, excessive potassium restriction or certain medications may contribute to hypokalemia, resulting in muscle weakness, fatigue, and cardiac conduction abnormalities (15).

The appropriate level of potassium intake depends on kidney function, serum potassium concentration, medications, acid-base status, and comorbid conditions. Patients with advanced CKD often require individualized dietary counseling regarding high-potassium foods, including bananas, oranges, melons, potatoes, tomatoes, dried fruits, dairy products, legumes, nuts, and salt substitutes containing potassium chloride. Cooking techniques such as soaking and boiling vegetables can reduce potassium content and expand dietary options for selected patients (16). Importantly, potassium bioavailability differs between food sources, with animal-derived foods generally exhibiting greater absorption than plant-based foods. Furthermore, poorly controlled diabetes, metabolic acidosis, and certain medications—including angiotensin-converting enzyme inhibitors and potassium-sparing diuretics—can further increase serum potassium levels (18). Therefore, regular laboratory monitoring and individualized dietary adjustments remain essential components of safe electrolyte management in CKD (17, 20) (Figure 1).

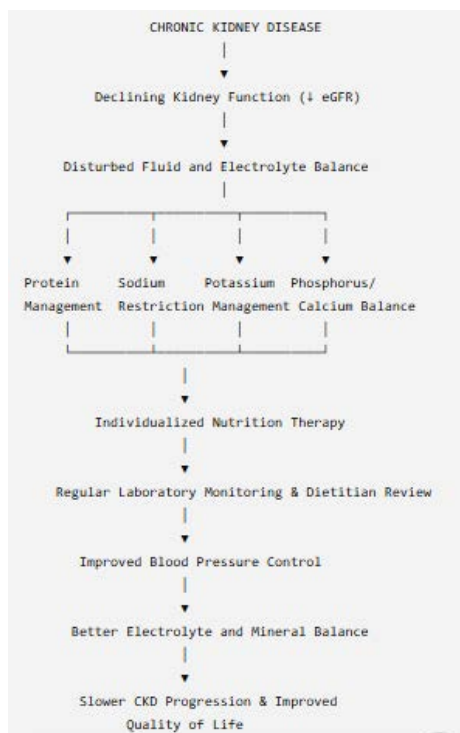


Figure 1: Nutritional Management Pathway in Chronic Kidney Disease.

Conclusion

In conclusion, nutrition is a fundamental component of chronic kidney disease management and should be adapted continuously as renal function, laboratory findings, comorbidities, and treatment requirements change. Appropriate dietary planning can support preservation of residual kidney function, improve blood pressure and metabolic control, reduce cardiovascular risk, and help prevent complications related to fluid, sodium, potassium, phosphorus, and protein imbalance. At the same time, excessive dietary restriction may increase the risk of malnutrition and protein-energy wasting, emphasizing the need for balanced and individualized recommendations rather than uniform dietary rules. Protein, sodium, potassium, calcium, phosphorus, and total energy intake should therefore be adjusted according to CKD stage, nutritional status, biochemical values, medication use, and whether the patient is receiving conservative therapy or dialysis. Regular monitoring is particularly important because electrolyte requirements may change over time and can be influenced by diabetes, metabolic acidosis, and commonly prescribed medications. Renal dietitians play a central role in translating clinical goals into practical meal plans, improving food choices, supporting adherence, and maintaining nutritional adequacy. Overall, personalized nutrition therapy, integrated with medical treatment, physical activity, and routine clinical follow-up, can contribute substantially to safer long-term CKD management and better patient outcomes across all stages of the disease.

REFERENCES

1. Kidney Disease: Improving Global Outcomes (KDIGO). KDIGO 2022 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. *Kidney Int.* 2024;105(4 Suppl):S1–S150.
2. Ikizler TA, Burrowes JD, Byham-Gray LD, Campbell KL, Carrero JJ, Chan W, et al. KDOQI Clinical Practice Guideline for Nutrition in CKD: 2020 Update. *Am J Kidney Dis.* 2020;76(3 Suppl 1):S1–S107.
3. Kalantar-Zadeh K, Fouque D. Nutritional management of chronic kidney disease. *N Engl J Med.* 2017;377(18):1765–1776.
4. Carrero JJ, Stenvinkel P, Cuppari L, Ikizler TA, Kalantar-Zadeh K, Kaysen G, et al. Etiology of the protein-energy wasting syndrome in chronic kidney disease. *J Ren Nutr.* 2013;23(2):77–90.
5. Ikizler TA. Optimal nutrition in patients with chronic kidney disease. *Kidney Int Suppl.* 2013;3(2):91–99.
6. National Kidney Foundation. KDOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure. *Am J Kidney Dis.* 2000;35(6 Suppl 2):S1–S140.
7. Fouque D, Kalantar-Zadeh K, Kopple J, Cano N, Chauveau P, Cuppari L, et al. A proposed nomenclature and diagnostic

- criteria for protein-energy wasting in acute and chronic kidney disease. *Kidney Int.* 2008;73(4):391–398.
8. Cupisti A, Brunori G, Di Iorio BR, D'Alessandro C, Pasticci F, Cosola C, et al. Nutritional treatment of advanced CKD: Twenty consensus statements. *J Nephrol.* 2018;31(4):457–473.
 9. Kalantar-Zadeh K, Tortorici AR, Chen JL, Kamgar M, Lau WL, Moradi H, et al. Dietary restrictions in dialysis patients: Is there anything left to eat? *Semin Dial.* 2015;28(2):159–168.
 10. Campbell KL, Carrero JJ. Diet and nutrition in chronic kidney disease: Current evidence and future directions. *Nat Rev Nephrol.* 2016;12(9):553–564.
 11. Levin A, Stevens PE, Bilous RW, Coresh J, De Francisco ALM, De Jong PE, et al. Kidney disease: Improving Global Outcomes (KDIGO) CKD guideline update. *Kidney Int Suppl.* 2013;3(1):1–150.
 12. Palmer SC, Maggo JK, Campbell KL, Craig JC, Johnson DW, Sutanto B, et al. Dietary interventions for adults with chronic kidney disease. *Cochrane Database Syst Rev.* 2017;(4):CD011998.
 13. Kopple JD. National Kidney Foundation KDOQI clinical practice guidelines for nutrition in chronic renal failure. *Am J Kidney Dis.* 2001;37(1 Suppl 2):S66–S70.
 14. Stenvinkel P, Carrero JJ, Axelsson J, Lindholm B, Heimbürger O, Massy ZA. Emerging biomarkers for evaluating nutritional status in chronic kidney disease. *Blood Purif.* 2010;29(2):138–143.
 15. Di Iorio BR, Bellasi A, Russo D. Mortality in kidney disease patients treated with phosphate binders: A review. *Clin Kidney J.* 2012;5(Suppl 1):i62–i68.
 16. Kovesdy CP. Updates in hyperkalemia: Outcomes and therapeutic strategies. *Rev Endocr Metab Disord.* 2017;18(1):41–47.
 17. Chauveau P, Aparicio M, Bellizzi V, Campbell K, Hong X, Johansson L, et al. Mediterranean diet as the diet of choice for patients with chronic kidney disease. *Nephrol Dial Transplant.* 2018;33(5):725–735.
 18. Carrero JJ, González-Ortiz A, Avesani CM, Bakker SJL, Bellizzi V, Chauveau P, et al. Plant-dominant low-protein diets for conservative management of chronic kidney disease. *Nat Rev Nephrol.* 2020;16(12):751–763.