



Nutritional management of kidney diseases: an unmet need in patient care

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Patients with kidney disease have unmet needs with regard to nutritional care throughout the world. This multi-layered issue arises from different, mainly educational, causes; one of them is that nutritional management is rarely included in the core curriculum of young nephrologists, and on the counterpart, detailed information on the management of the different phases of chronic kidney disease (CKD) is not systematically included in the educational programs of dietitians. Moreover, only a few specialized educational programs for “renal dietitians” are available in Europe. Since nutritional care exists in a delicate balance between two great paradigms, which are the need for standardization and for personalized medicine, there is great demand for an organized and systematic nutritional approach to complement the study programs of nephrologists and dietitians alike. In order to ensure the most valid approach, sharing scientific knowledge as well as clinical expertise and practice guidelines are paramount to achieving a good level of cooperation between nephrologists and dietitians.

It is noteworthy that knowledge of the nutritional aspects of kidney diseases, ranging from understanding the metabolic derangements related to nutritional disturbances to optimizing dietary regimens in kidney disease patients, has seen great progress in the last decades as exemplified in the upcoming New Clinical Practice Guideline for Nutrition in CKD 2020 of the National Kidney Foundation (NKF)/Kidney Disease Outcomes Quality Initiative (KDOQI) and Academy of Nutrition and Dietetics. As compared to the

previous guidelines published in the year 2000, there is increased attention to nutritional assessment (new methods and tools for body composition evaluation), to the role of dietary patterns as related to clinical outcomes, and to the effects of low protein diets (while maintaining an adequate nutritional status) in delaying the start of renal replacement therapy. Furthermore, there is an expanded section on phosphate and potassium metabolism. However, evidence of the efficacy of nutritional intervention is not so strong and could be undetermined by methodological issues such as lack of randomized controlled studies and great compliance variability in the few available trials [1]. The role of observational studies is controversial. This being said, the progress that has been made in this field has enabled a better nutritional care approach, but there is still more work to be done, especially in evaluating evidence-based strategies.

Adequate nutritional and dietary support is fundamental in all phases of kidney diseases, from the early stages of CKD to end stage kidney disease (ESKD), and is also crucial in dialysis management and after kidney transplantation. Diabetic kidney disease and kidney stone disease require specific nutritional approaches as well.

Many questions still remain unanswered, despite the growing interest towards renal nutrition being enhanced and reinforced by both evaluations of eco-sustainability in nephrology and by educational campaigns for healthier eating habits in the general population.

Both in CKD prevention and in the early stages of CKD, current evidence suggests the importance of the so-called “healthy diets”: Mediterranean or Dash diets are examples of dietary patterns based on salt limitation and on preference for plant-based and unprocessed food. If on the one hand these diets are much healthier, on the other they are characterized by a high potassium (K) intake (up to 4700 mg/day), which has led the nephrology community to fear that these diets may lead to hyperkalemia. This concern has induced the common belief that diets in CKD patients, even in those not at high risk of hyperkalemia, should be restrictive in K.

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It derives a dietary approach with low amounts of healthy foods, like fruits, vegetables, whole grains and nuts. The restriction of these foods from the diet may represent a risk for indirectly favoring the consumption of ultra-processed food, which in turn has a lower content of fiber, anti-oxidants, vitamins and prebiotics, and can lead to dysbiosis, higher production of uremic toxins by the gut, higher production of ammonia compounds and other non-desirable effects. Indeed, the dietary modulation of intestinal microbiota is a novel field of investigation that may guide how diet can ameliorate CKD and slow disease progression.

Aligned with healthier dietary patterns, recent studies have shown that plant-based diets are protective for developing CKD and for CKD progression, and are associated with a lower risk of mortality, which reinforces the importance of reviewing the paradigm of K restrictive diets for patients that do not have hyperkalemia [3]. Moreover, not all fruits and vegetables are rich in K, and adequate dietary counseling about the food options balanced to control serum potassium is needed and is timely [4]. Lastly, absorption of organic K in the gut from healthy foods is much lower than from K additives, which have often been used by the food industry in ultraprocessed food to replace NaCl to KCl and diminish Na content but not the salty taste [5]. Considering the aforementioned points, it is time to balance the pros and cons of dietary restrictions of K rich foods.

A major issue of dietary management is balancing the different retention rates of protein-wasting products, depending on actual protein intake and residual kidney function, and the different protein requirements in CKD, dialysis and transplantation.

Although diet in CKD has been closely associated with protein restriction, other changes in the so-called renal diets are discussed regarding sodium, phosphate, potassium and energy supply [6]. However, we have no conclusive information on the best choice between supplemented plant-based and high biological value low protein diets.

Notably, the CKD population has changed over time: patients are now older, with a greater prevalence of diabetes, cardiovascular comorbidities and frailty, so we need to move from a traditional approach of “transfer of recommendations” to patient-centered care, tailored to individual needs. This approach highlights that the shift toward an elderly and often frail population with CKD and ESKD also requires attention to the assessment of body composition and muscle function, alterations that may coexist with increased body fat, defining the dangerous picture of obese sarcopenia.

The goal of nutritional therapy in advanced CKD is to preserve good nutritional status and at the same time to delay dialysis start, and to prevent or correct signs, symptoms and complications of renal failure, namely uremic toxicity [7]. However, the implementation of nutritional programs is often challenged by the loss of appetite and anorexia, which

impairs good dietary adherence. Particularly for elderly people with CKD not on dialysis, attention to avoiding or treating muscle wasting is needed. In this case a delicate balance between avoiding the development of protein-energy-wasting (PEW) and diminishing the production of nitrogen urea compounds for the prevention of uremic syndrome is mandatory. Hence, provided energy intake is adequate, the optimal requirement of quantity and quality of proteins has not yet been defined for the different levels of residual renal function and age, which emphasizes the importance of constant follow-up with the nephrologist and dietitian to achieve the aforementioned goals.

Similarly, two major nutritional phenotypes may be identified in the dialysis setting: one progresses towards uremic syndrome, with insufficient control of metabolic waste products, and the other progresses towards PEW with progressive loss of lean body mass, with or without loss of body fat. Increasing the dialysis dose may at least partially improve the former, but the latter is difficult to improve, and both are associated with increased mortality. Further studies should address the physio-pathological adaptation and accommodation of PEW and the strategies to prevent or correct it.

Preservation of nutritional status, muscle mass and function is not only a matter of nutrient intake but also of metabolic status. Therefore, anabolic stimuli are crucial, and the most natural one is physical exercise. More knowledge about the type and duration of physical activity to be coupled with nutritional treatment is needed to avoid frailty and improve quality of life.

Kidney transplantation is the first-choice treatment of ESKD, though it is not a feasible option for all patients. Nutritional issues are highly relevant even in this phase. On the one hand, wasting and frailty are associated with negative outcomes in kidney transplant recipients, on the other, post-transplant diabetes, obesity and accelerated atherosclerosis have a major impact on the overall prognosis. Nutritional issues also regard living donors, both in the pre- and post-donation phases.

No kidney disease is trivial when diet is involved in its pathogenesis; for example, kidney stone patients need nutritional assessment and special dietary advice. Risk factors for uric acid and calcium nephrolithiasis are modifiable by dietary interventions. In addition, kidney stone disease is now considered a systemic disease, associated with an increased risk of hypertension, diabetes, metabolic syndrome and cardiovascular events.

A prominent clinical-practice issue is represented by the patient's adherence to the chosen dietary regimen and by the many barriers that prevent them from achieving this goal. Several strategies have been planned, but finding the best one that would allow to reach optimal nutritional goals still represents an important challenge [8]. In the past, educational interventions were mostly based on dietary advice.

But is this approach still effective? Innovative education approaches, such as self-management support, sharing decision making and the implementation of digital technologies should be included [9].

Health literacy is fundamental for the patient's empowerment as it improves individual access to health information and the ability to use it effectively. Many patients have low health literacy, and have difficulty with comprehension, communication and use of digital technology.

Telehealth approaches represent an important means of support to patients who need frequent "reinforcement" that the outpatient clinic timing does not allow, or who have difficulties attending the in-presence clinical setting. Nutritional counseling programs based on telehealth dietary interventions is innovative and cost-effective in communities where long distances represent a barrier to face-to-face nutritional education. Finally, the effort to facilitate dietetics by home delivered meals is quickly spreading. The use of a meal delivery service may especially benefit patients who live alone or have difficulties shopping and preparing meals, particularly when they have to follow special diets. Nutritional programs engaging both patients and/or family members are also desirable in order to translate dietary recommendations into accessible dietary plans.

In summary, nutritional issues in nephrology, dialysis and transplantation are important aspects of patient care. Besides new knowledge on the mechanism of protein and energy metabolism in renal patients, research should address implementation strategies to improve adherence and clinical outcomes.

To fulfill these needs, the new thematic series in the Journal of Nephrology on nutritional management of kidney disease seeks contributions encompassing every aspect of nutrition in renal diseases.

Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical statement Not applicable.

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