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OPTIMIZING HEALTH AND QUALITY OF LIFE IN CHRONIC KIDNEY DISEASE THROUGH NUTRITION: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Chronic kidney disease (CKD) affects over 700 million people globally and can lead to serious complications like hypertension, cardiovascular disease, and kidney failure. As CKD often progresses silently, early lifestyle changes especially dietary modification are crucial for slowing its progression.
Objective: This review evaluates recent scientific evidence on the effects of various dietary interventions on clinical, metabolic, and quality-of-life outcomes in people with CKD. It focuses on low-protein diets, sodium restriction, plant-based diets, omega-3 supplementation, time-restricted feeding, ketogenic diets, and educational programs.
Methods: Following PRISMA guidelines, a systematic review was conducted using PubMed, Scopus, and Web of Science for studies published from January 2020 to May 2025. Studies were included if they involved adults with CKD and tested a dietary intervention. A total of 23 studies met the criteria.
Results: Low- and very-low-protein diets, particularly with ketoanalogues, were generally safe and helped delay CKD progression. Sodium restriction lowered blood pressure and preserved kidney function in early stages. Plant-based diets and fiber supplements improved metabolic markers and toxin levels without causing hyperkalemia. Emerging approaches like ketogenic and time-restricted diets showed promise in improving weight and kidney health in select patients. Educational programs significantly enhanced dietary habits and health outcomes.
Conclusions: Diet is central to CKD management. Low-protein diets remain foundational, but combining them with plant-based foods, fiber, omega-3s, and structured education may offer greater benefits. Personalized, holistic dietary plans could improve outcomes and reduce dialysis risk, though more long-term studies are needed.

KEYWORDS

Chronic Kidney Disease, CKD, Dietary Intervention, Low-Protein Diet, Very-Low-Protein Diet, Ketoanalogues, Plant-Based Diet, Sodium Restriction, Omega-3 Fatty Acids, Fiber Supplementation, Time-Restricted Feeding, Ketogenic Diet, Nutritional Therapy, Renal Function, Patient Education

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Introduction

Chronic kidney disease (CKD) is a widespread and increasingly common disease, currently affecting over 700 million individuals worldwide. It is a major contributor to morbidity and mortality. It often leads to cardiovascular complications, reduced quality of life, and eventually end-stage kidney disease (ESKD) requiring dialysis or transplantation ["Association of omega 3 polyunsaturated fatty acids with incident chronic kidney disease: pooled analysis of 19 cohorts" by Kwok Leung Ong, Matti Marklund, Liping Huang et al.]. Early intervention is indispensable, as CKD often progresses silently and becomes irreversible if not appropriately treated.

Among the most important non-pharmacological strategies in chronic kidney disease management is dietary intervention. Nutritional therapy can help reduce the metabolic strain placed on the kidneys, control blood pressure, and alleviate symptoms like proteinuria. Low-protein diets (LPDs), typically providing 0.5-0.6 g/kg of protein per day, and very-low-protein diets (VLPDs), often supplemented with ketoanalogues and providing as little as 0.3–0.4 g/kg/day, have long been studied. These dietary approaches aim to slow the progression of chronic kidney disease (CKD) and delay the need for dialysis. ["Low protein diets for non-diabetic adults with chronic kidney disease" by Dag Olav Hahn, Emma M. Hodson, and Denis Fouque].

The rationale behind protein restriction is to reduce nitrogenous waste production, minimize glomerular hyperfiltration, and lower uremic toxin levels. In more advanced stages of CKD (stages 4–5), VLPDs supplemented with ketoanalogues have shown potential benefits in delaying dialysis initiation and improving metabolic outcomes ["Low protein diets for non-diabetic adults with chronic kidney disease" by Dag Olav

Hahn, Emma M. Hodson, and Denis Fouque]. However, concerns about malnutrition-especially in patients with comorbidities like diabetes-have limited the widespread use of strict protein restriction. In such cases, supplementation with ketoanalogues (non-nitrogenous analogues of essential amino acids) may help maintain nutritional balance without increasing nitrogen load ["Ketoanalogue Supplementation in Patients with Non-Dialysis Diabetic Kidney Disease: A Systematic Review and Meta-Analysis" by Vincenzo Bellizzi, Carlo Garofalo, Carmela Ferrara, and Patrizia Calella].

Sodium restriction is another commonly recommended dietary approach in CKD. Reducing salt intake, ideally below 2 grams per day, can help lower blood pressure and enhance the effectiveness of antihypertensive drugs like ACE inhibitors. However, its long-term benefits on clinical outcomes such as kidney failure and cardiovascular events remain debated ["Effect of a low-salt diet on chronic kidney disease outcomes: a systematic review and meta-analysis" by Honghong Shi, Xiaole Su, Chunfang Li, Wenjuan Guo, and Lihua Wang].

More recently, the role of dietary fats-especially omega-3 polyunsaturated fatty acids (n-3 PUFAs)-has gained attention. A large pooled analysis of 19 cohort studies found that higher circulating levels of seafood-derived n-3 PUFAs, such as EPA and DHA, were associated with a reduced risk of incident CKD and a slower decline in kidney function ["Association of omega 3 polyunsaturated fatty acids with incident chronic kidney disease: pooled analysis of 19 cohorts" by Kwok Leung Ong, Matti Marklund, Liping Huang et al.]. In contrast, plant-based n-3 PUFAs like alpha-linolenic acid did not offer the same protective effects.

Recent research also suggests a link between dietary interventions and gut microbiota in CKD. Low-protein diets may alter microbial composition, increasing beneficial species like *Lactobacillaceae* and reducing uremic toxin producers such as *Bacteroides eggerthii* and *Roseburia faecis*, although the clinical impact of these changes remains uncertain ["Gut Microbiota and Chronic Kidney Disease: A Target for Therapeutic Intervention" by Zhe Zhang, Xue-Feng Yang, and Jun Liao, published in *International Journal of Medical Sciences*].

Given the diversity of dietary strategies and mixed evidence from clinical studies, this systematic review aims to synthesize and evaluate the current literature on dietary interventions-including LPDs, sodium restriction, omega-3 supplementation, and ketoanalogue use-in patients with chronic kidney disease, with a focus on clinical, metabolic, renal, and nutritional outcomes.

Aim of the Study

The aim of this systematic review is to critically evaluate and synthesize the current evidence regarding dietary interventions in patients with chronic kidney disease (CKD). Specifically, the review focuses on how various dietary strategies-including low-protein diets, very-low-protein diets supplemented with ketoanalogues, sodium restriction, omega-3 fatty acid supplementation, plant-based diets, time-restricted feeding, ketogenic diets, and educational programs-affect clinical, metabolic, renal, nutritional, and quality-of-life outcomes across different stages of CKD. By compiling data from recent clinical trials and observational studies, this review aims to identify effective and safe dietary approaches that may slow CKD progression, reduce complications, and improve patient well-being.

Methods

This systematic review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The objective was to identify, evaluate, and synthesize recent clinical studies investigating dietary interventions in patients with chronic kidney disease (CKD), including but not limited to low-protein diets, ketoanalogue supplementation, sodium restriction, time-restricted feeding, plant-based diets, and educational programs.

Search Strategy

A comprehensive literature search was carried out using the electronic databases PubMed, Scopus, and Web of Science. The search included studies published from January 2020 to May 2025, to ensure that only recent and clinically relevant data were included. The following search terms were used in combination with Boolean operators (“AND”, “OR”):

"chronic kidney disease" OR "CKD", "diet" OR "dietary intervention" OR "nutrition" OR "low-protein diet" OR "plant-based diet" OR "sodium restriction" OR "ketoanalogues" OR "omega-3" OR "time-restricted feeding" OR "educational program".

Reference lists of all included articles were also manually screened to identify additional relevant studies.

Eligibility Criteria

Studies were included in this review if they met the following criteria:

- **Population**: Human subjects diagnosed with chronic kidney disease (any stage), including both non-dialysis and dialysis patients.
- **Intervention**: Any type of structured dietary intervention (e.g., low-protein diets, very-low-protein diets with ketoanalogues, plant-based diets, sodium restriction, omega-3 supplementation, ketogenic diets, fiber or probiotic supplementation, or time-restricted feeding).
- **Comparison**: Usual care, standard diet, or any control group as defined by the original study.
- **Outcomes**: Clinical, metabolic, nutritional, or renal outcomes (e.g., kidney function, proteinuria, blood pressure, body composition, quality of life, or inflammatory markers).
- **Study Design**: Randomized controlled trials (RCTs), controlled clinical trials, prospective cohort studies, or intervention studies.
- **Language**: Only studies published in English were included.

Exclusion criteria were:

- Animal studies or in vitro research,
- Review articles, meta-analyses, case reports, and editorials,
- Studies focused solely on pharmacological treatments without any dietary component.

Study Selection

After removal of duplicates, two independent reviewers screened the titles and abstracts of retrieved articles. Full texts were obtained for all potentially eligible studies. Disagreements regarding inclusion were resolved through discussion or consultation with a third reviewer.

Data Extraction

Data were extracted independently by two reviewers using a standardized data extraction form. The following information was collected from each included study:

- Authors and year of publication,
- Country and setting,
- Study design and sample size,
- CKD stage of participants,
- Type and duration of dietary intervention,
- Main outcomes measured (e.g., eGFR, urea, proteinuria, body weight, blood pressure, inflammatory markers),
- Key results and conclusions.

Quality Assessment

The methodological quality of included randomized controlled trials was assessed using the Cochrane Risk of Bias Tool, while cohort and non-randomized intervention studies were evaluated using the Newcastle-Ottawa Scale (NOS). Risk of bias was assessed in terms of randomization, allocation concealment, blinding, completeness of outcome data, and reporting bias. Studies were not excluded based on quality assessment but were considered in the interpretation of results.

Data Synthesis

Given the heterogeneity of the interventions, outcomes, and study designs, a narrative synthesis was performed instead of a meta-analysis. The results are grouped and presented according to the type of dietary intervention and key outcomes (e.g., renal function, nutritional status, quality of life). Consistencies and divergences between studies are highlighted, and implications for clinical practice and future research are discussed in the final section.

Literature Review Results

This review examined several studies exploring the impact of various dietary interventions on individuals with chronic kidney disease (CKD).. These interventions included low-protein diets, plant-based diets, ketogenic diets, time-restricted feeding, and also educational programs. The purpose in all studies was

to improve kidney function, reduce harmful waste products, and manage symptoms such as high blood pressure, phosphorus imbalance, or poor nutritional status.

One study investigated the impact of a very low-calorie ketogenic diet (VLCKD) in individuals with obesity and early-stage CKD. In this research, 92 participants adhered to a strict dietary regimen that included very low carbohydrate intake, moderate amounts of protein, and low fat for approximately three months.. The diet included supplements to prevent vitamin and mineral shortcomings. Participants lost around 20% of their body weight, mostly from fat. Their blood pressure, blood sugar, cholesterol, and triglycerides improved.First of all, kidney function either stayed stable or improved in some cases, suggesting that a medically monitored VLCKD could be a safe and favorable option for individuals with mild kidney disease. [Bruci et al., 2020].

In another study, 153 patients on peritoneal dialysis were given either ketoanalogue supplements or a placebo for one year. Both groups were on a 1.0 g/kg protein diet. Generally, both groups experienced kidney function decline. Anyhow, among those who began dialysis early, the group taking ketoanalogues had a slower loss of kidney function. No major side effects or signs of malnutrition were reported, indicating that ketoanalogues might be a helpful option for certain patients who begin dialysis at an earlier stage. [Chen et al., 2025].

An Italian study followed 223 patients with advanced CKD over six years. One group ate a standard low-protein diet (0.6 g/kg), and the other followed a very low-protein diet (0.3 g/kg) plus ketoanalogues. Both diets were safe and did not cause undernourishment. However, there were no differences in outcomes like dialysis need or death. The researchers came to the conclusion that adding ketoanalogues to a very low-protein diet does not offer extra benefits over a standard low-protein diet when patients are under profesional nephrology care [Bellizzi et al., 2022].

A new type of diet called the New Nordic Renal Diet (NNRD) was tested in people with stage 3–4 CKD. The diet was designed to be low in phosphorus, protein, and sodium, while still being nutritious and pleasant to follow. In a 26-week study, the NNRD group showed a 19% drop in phosphorus excretion and a 39% reduction in proteinuria. Blood levels of urea and sodium also showed improvement.Although kidney function (eGFR) remained unchanged, participants experienced reduced blood pressure and a decrease in abdominal fat, both of which contribute to a lower risk of cardiovascular disease. [Hansen et al., 2021].

The same research team examined how this dietary approach influenced patients' quality of life.After 26 weeks on the NNRD, participants reported less pain, better daily function, improved mood, sleep, and digestion. These positive effects were not observed in the control group, showing that the diet might enhance both physical and mental health. [Hansen et al., 2022].

Another useful intervention involved low-protein rice. In a Japanese study, 102 CKD patients were asked to eat low-protein rice at least twice a day. After 24 weeks, these patients showed larger decreases in both protein consumption and protein loss in urine compared to those following a typical low-protein diet. No adverse effects were reported, and patients' quality of life remained stable.This suggests that low-protein rice is a helpful instrument for maintaining dietary restrictions [Hosojima et al., 2022].

For older patients, a study tested combining a low-protein diet with a special nutritional formula containing energy, vitamins, and omega-3 fats.After three months, the group that received the formula showed better physical performance along with slight gains in muscle mass and body weight. They also consumed more essential nutrients.These results suggest that incorporating specific supplements into a low-protein diet may support the health and activity levels of older adults with CKD. [Yang et al., 2023].

Several studies looked at the gut microbiome and how diet affects it.One study discovered that a low-protein diet led to a decrease in beneficial gut bacteria that produce short-chain fatty acids such as butyrate, which play a key role in maintaining kidney and gut health.. Other metabolites and gut gene activity were also changed. This indicates that although limiting protein intake can benefit kidney function, it might have a negative impact on gut health and therefore requires careful management [Wu et al., 2020].A study called ProLowCKD tested probiotics longways a low-protein diet in people with advanced CKD. After three months, patients in the probiotic group showed reduced levels of toxic byproducts from gut bacteria and needed fewer medications for blood pressure. While kidney function remained the same, the findings suggest that probiotics, when used alongside dietary management, may help lower harmful toxins and support better outcomes in CKD. [De Mauri et al., 2022].

A major study conducted in the UK used Mendelian randomization to investigate how overall nutrient balance influences kidney health. Individuals with greater protein consumption were found to have a reduced risk of kidney failure, whereas those with higher fat intake faced an increased risk.

Carbohydrate consumption showed no definite impact. This suggests that diet can influence long-term kidney health even in otherwise healthy individuals. [Park et al., 2022].

Other study investigated the effects of adding dietary fiber (inulin) to a low-protein diet in individuals with moderate to advanced CKD. After 12 weeks, the group taking inulin had lower levels of protein-bound toxins like indoxyl sulfate and p-cresyl sulfate, as well as lower inflammation markers. Nutritional status was maintained, indicating that adding fiber is both safe and beneficial for individuals with CKD. [Chang et al., 2022].

In Thailand, a study tested whether a low-salt diet helps people with early-stage CKD. Over three months, those on a 1.5 g/day salt diet had slower kidney function decline and better blood pressure control compared to the control group. The diet was properly tolerated and showed no noxious effects, confirming the advantageous of salt restriction in early CKD [Trakarnvanich et al., 2022].

Another study conducted in Spain provided individualized dietary guidance to 75 patients with advanced CKD, emphasizing an increased intake of plant-based foods. After twelve months, patients who followed the adaptable plant-based diet experienced modest improvements in kidney function without developing high potassium levels. They also reduced their sodium and phosphorus intake and increased fiber intake. This shows that a relaxed, plant-rich diet can be safe and beneficial in advanced CKD [Martínez-Villaescusa et al., 2022].

A major Spanish study, PREDIMED-Plus, evaluated the effects of a Mediterranean diet paired with calorie restriction, physical activity, and behavioral counseling in older adults with obesity and metabolic syndrome. After one year, the intervention group experienced a slower decline in kidney function.Three years later, these benefits remained. Participants also achieved greater weight loss and increased physical activity, both of which contributed to better protection of their kidney health. [Martínez-Montoro et al., 2022].

In a different randomized trial, individuals with moderate to severe CKD were divided into four groups: one received dietary intervention only, another followed an exercise program only, a third combined both diet and exercise, and the fourth served as the control group. The diet group had a meaningful increase in adiponectin, a protective protein, while leptin levels stayed the same. The most significant improvement was observed in the diet-only group, suggesting that calorie restriction by itself may help lower inflammation and enhance metabolic function. [Aydemir et al., 2022].

A pilot study tested time-restricted feeding (TRF) in overweight and obese patients with CKD stages 3–4. Participants followed a low-protein diet within an 8-hour eating window. After 12 weeks, there was an improvement in kidney function, along with reductions in body weight, phosphorus, and uric acid levels. Advantageous shifts in gut microbiota were also noted.Time-restricted feeding (TRF) appears to be a safe and encouraging strategy for improving the health of people with CKD.. [Lao et al., 2022].

Educational strategies have also proven to be effective. A study conducted in China evaluated a six-month intensive education program aimed at helping dialysis patients manage their phosphorus levels. The program included group lectures, bedside teaching, printed materials, and videos delivered via WeChat. Following the program, a greater number of patients achieved normal phosphorus levels, showed better adherence to medications, and demonstrated higher knowledge scores.This shows that personalized education can lead to significant behavior changes [Yin et al., 2022].

An online education program was tested in South Korea using a platform called NAVER BAND. The program was designed to enhance dietary self-management in hemodialysis patients through the use of posts, videos, tasks, and interactive support.Patients who took part had better dietary behavior, lower phosphorus and potassium levels, and improved fluid control. Members also expressed increased confidence in handling their diets, indicating that digital tools can be effective in supporting CKD self-care. [Kim & Cho, 2022].

A brief initiative known as Jumpstart introduced participants to a whole-food, plant-based diet over a 15-day period. Patients with stage 3–4 CKD who participated in the program experienced reductions in blood pressure, cholesterol levels, and body weight.There were no accidents of dangerous high potassium levels. Dietary acid load, blood urea nitrogen, and phosphorus intake also dropped, all of which are favorable in CKD. This study showed that a plant-based diet can be harmless and helpful [Liebman et al., 2022].

Another study compared the effects of high-potassium versus low-potassium diets in individuals with stage 3 CKD. While the high-potassium group had some little lower blood pressure, two people developed hyperkalemia. This highlights the need for careful dietary management, particularly for patients who are prone to elevated potassium levels. [Turban et al., 2022].

To conclude, a study tested the effect of diet and exercise on a marker called circulating cell-free mitochondrial DNA (ccf-mtDNA), linked to inflammation. The group that combined diet and exercise had the highest rise in ccf-mtDNA levels, but this increase was not linked to heightened inflammation. This suggests

that these interventions are well-tolerated and do not increase damaging inflammation [Jaramillo Morales et al., 2022].

Discussion

This systematic review highlights the growing body of evidence supporting the use of dietary interventions in the management of chronic kidney disease (CKD). A range of nutritional strategies—including low-protein diets, ketoanalogue supplementation, sodium restriction, plant-based diets, fiber enrichment, omega-3 supplementation, and time-restricted feeding—were shown to influence clinical, metabolic, and renal outcomes. While many of these interventions yielded promising results, their effectiveness varied depending on CKD stage, patient characteristics, and the level of dietary adherence and supervision.

Low-protein diets (LPDs) and very-low-protein diets (VLPDs), often supplemented with ketoanalogues, emerged as a cornerstone intervention. Consistent with earlier studies, LPDs were associated with improvements in metabolic markers and reductions in uremic toxins, without significantly compromising nutritional status when properly monitored. Several studies reviewed, including those by Bellizzi et al. (2022) and Chen et al. (2025), confirmed that VLPDs with ketoanalogues are generally safe and may delay disease progression in select populations. However, these benefits were not universal; Bellizzi and colleagues found no significant difference in outcomes such as dialysis initiation or mortality between LPDs and VLPDs when patients received professional nephrology care. This suggests that the added value of ketoanalogue supplementation may be context-dependent, offering more benefit to patients with poor dietary adherence or limited access to medical support.

Sodium restriction showed modest but significant benefits, particularly in early CKD. The Thai study by Trakarnvanich et al. (2022) showed slower renal decline and improved blood pressure with a 1.5 g/day salt intake. However, evidence for long-term outcomes such as cardiovascular events or dialysis onset remains limited. These findings support the continued recommendation of sodium restriction as part of CKD management but highlight the need for longer follow-up to determine its true impact on hard clinical endpoints.

Plant-based diets and fiber supplementation also demonstrated a favorable effect on kidney health and metabolic balance. Multiple studies, including Martínez-Villaescusa et al. (2022) and Liebman et al. (2022), showed that plant-rich diets reduced uremic toxin levels, improved blood pressure, and preserved kidney function. The addition of fiber—especially inulin—further enhanced these benefits by reducing protein-bound toxins and inflammatory markers, as noted in Chang et al. (2022). These outcomes align with the emerging understanding of the gut–kidney axis, suggesting that manipulating the gut microbiome via dietary means may offer an innovative adjunctive strategy in CKD care.

However, not all dietary interventions were without concerns. Studies examining gut microbiota modulation, such as those by Wu et al. (2020) and De Mauri et al. (2022), revealed that while low-protein diets reduce uremic toxin-producing bacteria, they may also diminish short-chain fatty acid producers, which are essential for gut health. This dual effect underscores the complexity of the microbiome's relationship with renal health and the need for more targeted research to optimize microbial modulation in CKD patients.

Ketogenic and time-restricted diets are newer and less conventional strategies that yielded encouraging results in early-stage CKD and obese patients. Bruci et al. (2020) and Lao et al. (2022) showed that these diets led to weight loss, improved metabolic parameters, and stable or improved kidney function. Yet, their application remains limited due to concerns about sustainability, long-term safety, and potential electrolyte imbalances. These interventions should therefore be reserved for well-selected patients under close supervision.

The review also identified the value of educational interventions in enhancing dietary adherence and improving biochemical outcomes. Programs such as those implemented by Yin et al. (2022) and Kim & Cho (2022) demonstrated that both in-person and digital education significantly improved patients' dietary behaviors, knowledge, and laboratory parameters. This suggests that the success of dietary interventions depends not only on the content of the diet itself but also on the delivery method and the level of patient engagement and support.

Interestingly, evidence regarding macronutrient distribution in the general population, as seen in the Mendelian randomization study by Park et al. (2022), found that higher protein intake was protective against CKD development, while higher fat intake increased risk. These findings may seem contradictory to the low-protein recommendations in CKD, but they highlight the distinction between prevention and management: higher protein intake may support kidney health in healthy individuals but exacerbate decline in those with established CKD. This supports a nuanced, stage-specific approach to dietary planning.

Collectively, these studies reinforce the notion that no single dietary strategy is universally superior for all CKD patients. Instead, interventions must be tailored to the individual, taking into account disease stage,

comorbidities, nutritional status, and patient preferences. For example, low-protein rice or nutritional formulas may enhance adherence and mitigate malnutrition in older adults (Hosojima et al., 2022; Yang et al., 2023), while Mediterranean-style or Nordic diets may improve cardiovascular risk factors and quality of life without compromising kidney health (Hansen et al., 2021; Martínez-Montoro et al., 2022).

Moreover, combined interventions—diet plus physical activity or behavioral support—frequently produced more robust improvements in weight, inflammation, and renal outcomes than diet alone. This was evident in studies like Aydemir et al. (2022) and Jaramillo Morales et al. (2022), which showed that multimodal interventions can improve metabolic function without exacerbating inflammation. These findings suggest that integrated care models may be the most effective path forward.

Limitations in the current literature include short follow-up periods, small sample sizes in several studies, and limited generalizability across diverse populations. There remains a need for large, long-term randomized trials to confirm the sustainability and efficacy of emerging strategies such as time-restricted feeding, microbiota-targeted interventions, and plant-based diets in late-stage CKD. Additionally, concerns around hyperkalemia in high-potassium diets (as seen in Turban et al., 2022) underscore the importance of regular monitoring and individualized plans.

In conclusion, dietary interventions hold substantial promise in managing CKD and improving patient outcomes. While LPDs remain a foundation of nutritional therapy, novel approaches such as plant-based diets, fiber supplementation, omega-3 intake, and personalized education are expanding the therapeutic landscape. Tailored, patient-centered strategies—delivered alongside multidisciplinary care—are essential for maximizing benefits and minimizing risks in this vulnerable population.

Conclusions

Dietary interventions play a vital role in managing chronic kidney disease (CKD). Low-protein diets, especially when supplemented with ketoanalogues, remain a core strategy for slowing disease progression. In addition, plant-based diets, fiber supplementation, sodium restriction, and omega-3 fatty acids have shown benefits in improving kidney function, metabolic health, and reducing inflammation.

Newer approaches such as time-restricted feeding, ketogenic diets, and structured educational programs offer additional tools to enhance patient outcomes, particularly when tailored to individual needs and supervised by healthcare professionals. Importantly, educational interventions—both digital and face-to-face—consistently improved dietary adherence and clinical markers.

While the overall evidence is encouraging, more long-term, large-scale studies are needed to confirm the effectiveness and safety of these strategies across different CKD stages. A personalized, patient-centered approach that integrates dietary therapy with lifestyle support and regular monitoring remains key to improving outcomes and quality of life in people living with CKD.

Authors' Contributions Statement

All authors have read and agreed with the published version of the manuscript.

All authors have reviewed and agreed to the publication of the final version of the manuscript.

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