Dietary Approach to Chronic Kidney Insufficiency (CKI)
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Abstract

Patients with Chronic Kidney Disease (CKD) and End Stage Renal Disease (ESRD) are at major risk for malnutrition characterized by protein energy wasting and micronutrient deficiency. Studies show a high prevalence rate of malnutrition among this patient population which affect their survival and quality of life. Malnutrition increases the risk of morbidity, mortality and overall disease burden in these patients.

The present review which consists of data, reports, guidelines, published research studies clearly suggested that a multidisciplinary approach including diet, nutrition, lifestyle and exercise may be a gold standard in the treatment of CKD. Analysis of reports, guidelines, published researches demonstrated that the nutritional status, treatment and diagnostic parameters of these patients should be altered to achieve progress not only in their mortality outcome but also to improve their quality of life. In fact, dietary interventions may also be used for the conservative management of CKD or as a means of delaying or avoiding dialysis therapy by slowing the progression of Chronic Kidney Disease (CKD), End Stage Renal Disease (ESRD) and delaying the need of Renal Replacement Therapy (RRT).

Keywords: Nutrition; Diet; Chronic Kidney Insufficiency (CKI)

Abbreviations: CKI: Chronic Kidney Insufficiency; ESRD: End Stage Renal Disease; DM: diabetes mellitus; RRT: Renal Replacement Therapy; CKD: Chronic Kidney Disease; SGA: Subjective global assessment; IDWG: Interdialytic weight gain; HD: Haemodialysis; MIS: Malnutrition-Inflammation Score; DMS: Dialysis Malnutrition Score; BMI: Body mass index; DEXA: Dual energy X-ray absorptiometry

Introduction

For nearly five decades, kidney disorders emerged as major health challenge to the health care professionals and policy makers. In view of above a comprehensive strategy has been put forward by the researchers and scientific community, accompanying the concept of nephroprotection and different regimen of management including diet, nutrition, and modification in life style, exercise etc \cite{1}. So the previous way of management has been tweaked recently from a model focused only on treatment to the concept and strategy that balance the relationship between prevention and care which can pave the way to not only a comprehensive management of kidney disorder but also play a pivotal role in preventing the progression of Chronic Kidney Disease (CKD) and delaying the need of renal replacement therapy in End stage renal disease (ESRD) \cite{2, 3}.

The kidney disease has been redefined now a day as Chronic Kidney Disease (CKD), a progressive condition that culminates in End stage renal disease (ESRD) and that in most of the cases it can be effectively treated in its earlier stages so that prevention is now a realistic possibility.

Thus ultimate goal for the Nephro protection of the different regimen is as follows:

- Good Dietary Practice and intake of proper nutrition.
- Lifestyle modification, cessation of smoking, alcohol etc.
- Exercise and weight management.
- Preservation of renal function as long as possible.
- Treating the kidney disease at the onset/primary stage.
- Slowing the progression of kidney disease.
- Delaying the need of RRT to maximum possible extent.
- To reduce the accumulation of metabolic wastes, fluids and electrolytes.
- To prevent metabolic complications of CKD.
- To replace nutrients lost with dialysis.
- To promote a satisfactory nutritional status.
- To manage the associated disorders such as hypertension, diabetes, cardiac ailments etc.

Keeping in view of above nephro protective regimen for CKD involves a multidisciplinary approach that may be typically includes some therapeutic measures, scientifically validated herbs and natural products which have been investigated for their curative as well as protective effect along with good dietary habits, proper nutrition, exercise, lifestyle modification etc \cite{3}. Nevertheless, to say that the important risk factors for Chronic Kidney Disease (CKD) include diabetes mellitus, hypertension, obesity and smoking. So the disciplined life style with proper nutrition and controlled diet, exercise, smoking cessation and

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weight management can make a difference in retarding the progression of CKD [4].

**Importance of Nutrition in CKD**

Malnutrition is prevalent in both developing and developed countries, and is an important risk factor for morbidity and mortality. Unlike in developing countries where malnutrition is linked to poor socioeconomic conditions, malnutrition in the developed countries typically occurs in the context of acute or chronic illness [5, 6]. While acute illness primarily affects weight however chronic illness impacts linear growth [5].

In patients with CKD and ESRD, prominent metabolic and regulatory derangements occur including acidosis, systemic inflammation, and hormonal dysregulation that have been attributed to the development of hyper-catabolism and risk for negative nitrogen balance.

The right choice of Nutrition according to the pathophysiological condition of kidney plays a major role in the protection of renal function and well-being in the CKD patient [5, 6]. Recent studies show that the good dietary practice and intake of proper nutrition helps in reducing risk factors and fighting against comorbid conditions [6]. A recent study reported that there was a favourable association between a modified Alternative Healthy Eating Index score and progression of CKD [7]. Also, unhealthy dietary patterns were positively related to progression of CKD [8].

Nowadays it is better way to manage the CKD with nutrition-based preventive and curative interventions and this concept is rapidly growing. There is enough evidence that health professionals can do better by utilizing current nutrition knowledge along with other important measures [9].

Furthermore, some published studies have demonstrated that the good nutrition practice played significant role in wellbeing of the patients having CKD. Best nutrition practices have been shown to improve patient outcomes and reduce health care costs. This is a matter of fact that despite the profound impact of good nutrition on health and wellness, the science of nutrition and its application to healthcare are not comprehensively integrated in training programs and treatment regimen.

Therefore, the patient and the professionals remain unaware about the correct nutritional advice. The cooperation between nephrologist, nutritionists and dietician is the gold standard for the management of CKD especially in combating to the steeply rising problem of CKI. It is a very important strategy for the physician to develop expertise also in diet and nutrition for the rising problem of CKI. It is a very important strategy for the physician to develop expertise also in diet and nutrition for the rising problem of CKI. It is a very important strategy for the physician to develop expertise also in diet and nutrition for the rising problem of CKI.

A dietician and nutritional expert have significant role to assess nutritional status, requirement, and carefully monitor well being and outcomes of patient and able to suggest a comprehensive diet and nutrition plan according to different stage of CKD or ESRD and dialysis. The core responsibility of a dietician is to educate and advise patients by translating scientific information about nutrition into practical advice. Without appropriate assessment and implementation of required nutritional intake of individuals’ neither of those tasks i.e. goal of nephron protection and effective treatment cannot be accomplished. More over the dietician is also responsible to maintain records of obtained data, findings, suggested actions and outcomes for each patient who provides useful information for the physician and other members of the multidisciplinary team in decision making for further nutritional management and medical treatment of patients. Good nutritional status is a well-known marker of well-being in patients with Chronic Kidney Disease (CKD). Protein Energy Malnutrition (PEM) develops during the course of CKD and is associated with adverse outcomes.

A recent study reported that there is a favorable association between a modified Alternative Healthy Eating Index score and progression of CKD. While unhealthy dietary patterns are positively related to progression of CKD [12, 13]. Along with major risk factor patients of CKD and ESRD must ensure to modify their dietary habits to healthy diet which make up the optimum nutritional level which has been suggested to keep the kidney to meet out the challenge and achieve the goal of nephro protection in real manner, because nutritional status also deteriorates as renal disease progresses. While malnutrition is common in CKD stages 4-5. Some observational studies suggested that it can occur as early as stages Therefore, close monitoring of nutritional status, including protein and energy intakes, is recommended.

**Nutritional Status in CKD**

The data collected in some recently published studies which were carried out for the assessment of the nutritional status of CKD patients with advanced CKD (stages 3–5), suggested varied degree of poor nutritional status. The 20-60% of the CKD patients have malnutrition of varied degree while in stage 4–5 have mild to severe malnutrition assessed by Subjective Global Assessment (SGA) is reported in 44% of patients, including 30% of patients on hemodialysis and 40% of patients on peritoneal dialysis. Serum albumin concentration has been identified as the most powerful indicator of mortality similarly in stages 4–5, mild to severe malnutrition and the low value of albumin and creatinine before dialysis has been considered an increased risk for mortality and morbidity during the past few years [14]. A low value of serum albumin is considered to be 3.5–4.0 g/dl, which may increase the relative risk of death as compared to 4.0 g/dl or higher. On the
other hand, decreases in creatinine (an indicator of muscle mass) and ideal weight have also been associated with increased risk of death in the patient population [15].

The nutritional status of hemodialysis patients is still often neglected in many dialysis centers around the world, although the benefits of ascertaining the anthropometric and dietary history of this population are known. There is still no uniform method for evaluating these patients' nutritional status, and what is recommended is that a set of subjective and objective methods (overall history, food intake, physical examination, anthropometric measurements and biochemical tests) should be applied in order to arrive at an adequate nutritional diagnosis.

Malnutrition is a common problem in these patients and the possible causes of malnutrition include inadequate dietary intake of calories and protein as well as increased catabolism of protein from chronic inflammation. Malnutrition often associated with poor quality of life, impaired immune defense mechanism, as well as poor clinical outcomes [16-18].

Laboratory Parameters Used for the Assessment of Nutritional Status

Current laboratory parameters used for the assessment of nutritional status include serum concentrations of albumin, prealbumin, creatinine, cholesterol, transferrin, potassium, phosphate, and trace metals. In addition, dry weight and interdialytic weight gain (IDWG) have been used to assess overall nutritional status.

The Subjective Global Assessment (SGA) is another measure of nutritional status in patients on maintenance hemodialysis (HD). The SGA consists of a four item scale including questions regarding ‘dietary intake and gastrointestinal symptoms change in weight over the previous 6 months, muscle mass and visual assessment of subcutaneous tissue. Higher scores connote ‘better dietary intake,’ increased appetite, and absence of symptoms attributable to gastrointestinal dysfunction. Evaluation of subcutaneous tissue and muscle mass is also part of the scoring. The different components are summed to determine the total SGA score [19].

Another measurement tool is the comprehensive Malnutrition-Inflammation Score (MIS). Given the known links between malnutrition, inflammation and increased mortality in HD patients, Kalantar-Zadeh et al developed this measure to quantitatively assess the severity of this condition [20]. The score consists of portions of the SGA and the Dialysis Malnutrition Score (DMS), as well as the Body Mass Index (BMI), serum albumin, and total iron-binding capacity. The MIS ranges from 0 to 30, with higher scores signifying worsening malnutrition and inflammation. The authors evaluated the MIS score and compared it to SGA and DMS scores. MIS was associated with length and frequency of hospitalization, with higher correlation coefficients achieved with MIS compared to SGA and DMS. The investigators concluded that the MIS may be superior to the conventional SGA and DMS, as well as to individual laboratory values, as a predictor of dialysis outcome and an indicator of malnutrition inflammation complex syndrome [20].

This new tool relies on clinical judgment derived from grading scales calculated from a brief history and physical examination, which aids in the prediction of nutrition-associated clinical outcomes in different conditions [10]. The tool has many strengths in the clinical and research settings because it is inexpensive, easy to conduct, and can be used effectively by providers from different disciplines [21].

Anthropometric Measures to Assess Nutritional Status in Haemodialysis Patients

Over more than 30 years, anthropometry has been used as a marker of nutritional status and body composition in patients with and without renal disease. Anthropometry consists of a group of non-invasive and simple methods to estimate body composition [6, 22, 23]. Anthropometric measures used to estimate overall nutritional status in HD patients include skeletal frame size, body weight, height, skin fold thickness, mid-arm muscle circumference, percent of body mass that is fat, percent of usual body weight, percent of standard body weight, and the BMI. Anthropometric measures provide an estimate of body composition by tissue distribution, including the bone, muscle, and fat compartments [22, 23].

BMI is another anthropometric measure frequently used to assess nutritional status in HD patients. BMI is estimated by dividing weight (in kilograms) by height (in squared meters). ESRD patients treated with HD with higher BMI have increased survival over a 1-year period [24-26]. In the general population, patients with lower BMI usually have increased survival [27]. Further research is needed in this area to explain the reasons for the differences between the findings in the general population and ESRD patients. Skin fold thickness is another anthropometric measure used to evaluate malnutrition. It is important to evaluate skin fold thickness at four separate sites [28]. Whole body dual energy X-ray absorptiometry (DEXA) is another tool used to evaluate malnutrition in ESRD patients. Like anthropometric measures, DEXA is a method to evaluate body composition, including bone mineral mass, density, fat and fat-free mass. DEXA is more precise and accurate when compared to anthropometry in HD patients [6, 29, 30]. Anthropometric measures may be subject to variation due to changes in volume status that typically occur in ESRD patients [22, 30]. In addition, anthropometric measurements are operator-dependent. However, higher costs must be considered before ordering this study [29, 30]. Further study of the relationship of DEXA measures with other factors in this patient population, including outcomes, is needed. The ideal method for the nutritional assessment of dialysis patients is yet to be defined. Conventional SGA seems to be the one that should be used for screening and following up dialysis patients aiming at nutritional diagnosis, followed by PG-SGA. In addition, BMI should be used in that population with a cut-off point different from the one recommended by the World Health Organization for the general population [31]. Assessment by use of skin fold thickness at four sites is recommended. BMI is another anthropometric measure frequently used to assess nutritional status in HD patients. BMI is estimated by dividing weight (in kilograms) by height (in squared meters). ESRD patients treated with HD with higher BMI have increased survival over a 1-year period [24-26]. In the general population, patients with lower BMI usually have increased survival [27]. Further research is needed in this area to explain the reasons for the differences between the findings in the general population and ESRD patients. Skin fold thickness is another anthropometric measure used to evaluate malnutrition. It is important to evaluate skin fold thickness at four separate sites [28]. Whole body dual energy X-ray absorptiometry (DEXA) is another tool used to evaluate malnutrition in ESRD patients. Like anthropometric measures, DEXA is a method to evaluate body composition, including bone mineral mass, density, fat and fat-free mass. DEXA is more precise and accurate when compared to anthropometry in HD patients [6, 29, 30]. Anthropometric measures may be subject to variation due to changes in volume status that typically occur in ESRD patients [22, 30]. In addition, anthropometric measurements are operator-dependent. However, higher costs must be considered before ordering this study [29, 30]. Further study of the relationship of DEXA measures with other factors in this patient population, including outcomes, is needed. The ideal method for the nutritional assessment of dialysis patients is yet to be defined. Conventional SGA seems to be the one that should be used for screening and following up dialysis patients aiming at nutritional diagnosis, followed by PG-SGA. In addition, BMI should be used in that population with a cut-off point different from the one recommended by the World Health Organization for the general population [31]. Assessment by use of skin fold thickness at four sites is recommended.
blood lipid changes have been observed in type 2 diabetic patients. It is not a settled issue, an increasing body of evidence indicates that high-protein diets may improve blood lipid profiles and is associated with lower protein intake [35]. Although this protein intake has been shown to be inversely related to cardiovascular disease in a cohort of over 80,000 women [36]. In numerous population studies, higher blood pressure has been associated with lower protein intake [36]. Because protein has three times the thermic effect of either fat or carbohydrate, and because it has a greater satiety value than do fat or carbohydrate, increased dietary protein may represent an effective weight-loss strategy for the overweight or obese [40]. Indeed, recent clinical trials have shown that calorie-restricted, high-protein diets are more effective than that are calorie-restricted, high-carbohydrate diets in promoting and maintaining weight loss in overweight subjects, while producing less hunger and more satisfaction [41].

Aims and Objective of Nutrition for Kidney Patient

The nutritional support for the CKD and ESRD patient during HD aimed to

- To maintain a healthy weight.
- To keep blood pressure down.
- To manage blood glucose levels in diabetic patient.
- To reduce cholesterol levels.
- To reduce the accumulation of metabolic wastes, fluids and electrolytes.
- To prevent metabolic complications of CKD.
- To replace nutrients lost with dialysis.
- To promote a satisfactory nutritional status.

Protein Intake and Risk Factors for Chronic Kidney Disease

Lately there has been an explosion of interest in the area of protein intake, largely triggered by high-protein diets proposed for weight loss and metabolic control. On the other hand, there has been intense debate on the role of high-protein diets increasing the risk of development and progression of CKD. Current advice for reducing the risk of chronic diseases has been to limit the fat intake to 30% of total energy, to maintain protein at 15% of total energy, and to increase complex carbohydrates to 55–60% of total energy [32]. Both the actual macronutrient intakes and suggested healthy levels differ considerably from average levels obtained from studies of hunter gatherers in which dietary protein is characterized as elevated (19–35% of energy) at the expense of carbohydrate (22–40% of energy) [33]. In addition, the Mediterranean diet, which is consistently associated with longevity and quality of life, is also characterized by a relatively high (up to 25%) protein content, mainly from seafood sources. It is important to highlight, however, that many other components of this healthy diet, such as fibers, omega-3 fatty acids, fat intake (mostly in monounsaturated and polyunsaturated forms), olive oil, wine, garlic and herbs may also play a role in the benefits [34]. Relatively little evidence has been gathered regarding the effect of protein intake on the development of chronic diseases. A prospective observational study (the Nurses’ Health Study) has investigated the association between dietary protein intake and vascular complications, showing that women who ate the most protein were less likely to have had a stroke [35]. Although this is not a settled issue, an increasing body of evidence indicates that high-protein diets may improve blood lipid profiles and reduce the risk of cardiovascular disease [36]. Similar beneficial blood lipid changes have been observed in type 2 diabetic patients in conjunction with improvements in glucose and insulin metabolism [37]. In obese women, hypo caloric, high-protein diets improved insulin sensitivity and prevented muscle loss, while hypo caloric, high-carbohydrate diets worsened insulin sensitivity and caused reductions in fat-free mass [38]. Interestingly, epidemiologic evidence supports the clinical data, showing a cardiovascular protective effect of dietary protein. Protein intake has been shown to be inversely related to cardiovascular disease in a cohort of over 80,000 women [36]. In numerous population studies, higher blood pressure has been associated with lower protein intake [36]. Because protein has three times the thermic effect of either fat or carbohydrate, and because it has a greater satiety value than do fat or carbohydrate, increased dietary protein may represent an effective weight-loss strategy for the overweight or obese [40]. Indeed, recent clinical trials have shown that calorie-restricted, high-protein diets are more effective than that are calorie-restricted, high-carbohydrate diets in promoting and maintaining weight loss in overweight subjects, while producing less hunger and more satisfaction [41].

Important risk factors for Chronic Kidney Disease (CKD) include diabetes mellitus, hypertension, obesity and smoking. Modification of lifestyle habits (e.g. healthy diet, physical exercise, smoking cessation, moderate alcohol consumption and weight loss in obese people) may therefore be of value in retarding the progression of CKD. In addition, restriction of dietary protein and augmentation of fluid intake have been recommended as a treatment for retarding CKD progression for over 50 years [42, 43]. Chronic kidney disease is usually a slowly progressive disease, in which the expected worsening of the renal function and the expected metabolic complications can be improved by the suitable diet. It is known that nutritional therapy for chronic kidney disease is an equivalent therapeutic agent lowering uremic toxicity, reducing the risk of malnutrition and slowing the progression of chronic kidney disease. The most important measure for nutritional therapy in pre-dialysis period is thus the protein restriction with the equivalent energy intake. It is important that there is no protein-energy malnutrition during this period. The role of health care workers in this period is important for the patient’s long term status. The progression of chronic kidney disease towards the renal failure is gradual; therefore a good protein-energy status is even more important. In the dialysis period, the protein intake can be increased, thereby avoiding the protein-energy malnutrition, which is a strong prognostic factor for morbidity in patients with chronic kidney disease.

Nutritional status deteriorates as renal disease progresses. While malnutrition is common in CKD stages 4-5, observational studies suggested that it can occur as early as stages 3. Therefore, close monitoring of nutritional status, including protein and energy intakes, is recommended [44].

Good nutritional status is a well-known marker of well-being in patients with Chronic Kidney Disease (CKD). Protein energy malnutrition (PEM) develops during the course of CKD and is associated with adverse outcomes. Although most of the overt symptoms of uraemia diminish or disappear after...
A protein intake between 1.0 and 1.4 g/kg body weight/day is needed to maintain a neutral nitrogen balance in dialysis patients. Studies have shown that an average protein intake of 1.2 g/kg IBW/day is associated with the highest survival in epidemiological studies while values below 0.9 g/kg body weight/day are predictive of lower survival [51]. At least 50% of proteins should be of high biological value, i.e. they should provide essential amino acids [52].

- Animal foods (meat, fish, eggs, milk and its derivatives) should be present in the diet as they contain essential amino acids, i.e. amino acids that can only be obtained from the diet.

- If a patient has dyslipidaemia, the consumption of fatty sources of proteins (e.g. sausages and cheese) should be reduced and visible fat should be removed from foods.

- If the patient has an aversion to meat, other protein sources should be suggested (eggs and legumes) in order to avoid malnutrition.

Patients with chronic kidney failure, have high prevalence of protein-energy malnutrition. This is characterized by changes to serum proteins and imbalance between the protein and fat components of the organism [46]. Among the main causes of protein-energy malnutrition in this population are changes to energy metabolism and calorie levels, hormonal disorders, poor food intake, anorexia, nausea and vomiting, relating to the constant state of inflammation and uremic toxicity and occurrences of concomitant infection and inflammation [47]. Since good nutritional status among patients with chronic kidney failure is associated with reduction of comorbidities, protein-energy malnutrition is considered to be a marker of poor prognosis. The prevalence of malnutrition among chronic hemodialysis patients ranges from 10 to 70%, and this malnutrition has frequently been documented in terms of reduction of subcutaneous fat deposits and loss of muscle mass, as assessed using simple anthropometric methods, and in terms of reductions in the levels of body nitrogen, serum albumin, transferrin and other visceral proteins. Nutritional markers such as serum albumin and low body mass index are associated with higher mortality rates in this population [48].

The ultimate goal is to ensure that adequate body fat levels are maintained. This is very important in relation to patients on hemodialysis, because at times of greater energy demand to which they are exposed (vascular access surgery, infections or even kidney transplant), the fat reserves can be used to supply the energy deficit, thereby safeguarding the patient’s protein reserves [49].

In a prospective cohort study over 11 years, Knight et al. examined the impact of protein intake on renal function decline in women with normal renal function (estimated GFR > or = 80 mL/min/1.73 m2) or mild renal insufficiency (estimated GFR 55 to 80 mL/min/1.73 m2). It involved 1624 women enrolled in the Nurses’ Health Study. The authors concluded that high protein intake was not associated with renal function decline in women with normal renal function. However, high total protein intake, particularly high intake of non-dairy animal protein, may accelerate renal function decline in women with mild renal insufficiency [50].

Renal disease is associated with impaired protein metabolism and population studies suggest that CKD patients tend to spontaneously decrease their protein intake. Metabolic studies have shown that an average protein intake of 1.2 g/kg IBW/day is needed to maintain a neutral nitrogen balance in dialysis patients. A protein intake between 1.0 and 1.4 g/kg body weight/day is associated with the highest survival in epidemiological studies for which excess salt intake induces an increase in blood pressure. These include the suppression of the activity of the renin-angiotensin system and sympathetic nervous system during salt loading, increased activity of Na-K ATPase, and changes in nitric oxide (NO) activity contributing to increased oxidative stress. Such effects are observed in patients with essential hypertension [54].

The data from the animal studies, Cianciaruso et al analyzed prospectively the progression of chronic kidney disease in hypertensive patients with baseline creatinine clearances between 10 and 40 mL/min who were divided into two groups based on consistent urine sodium excretion rates of either <100mEq/day or >200mEq/day [55]. Mean blood pressures of the groups did not differ, and both glomerular and tubulointerstitial diseases were present in both groups. The rate of decline in creatinine clearance was greater in the high-salt group compared with the low-salt group. Proteinuria increased in the high-salt group and decreased in the low-salt group. Also, reduction of salt intake enhances the anti-proteinuric effect of angiotensin-converting enzyme inhibitors [56]. Together, the data support the notion...
Dietary control alone can lead to malnutrition; phosphate is tied to protein intake [60]. Most patients require the intake of phosphate binders to control phosphate levels while still achieving adequate nutrition.

**Potassium**

Control of dietary potassium is important to prevent hyperkalaemia between dialysis sessions. The kidney excretes 90% of dietary potassium and the intestinal excretion of potassium is increased during CKD, as a compensatory mechanism. For this reason, constipation may favour hyperkalaemia while diarrhoea may be responsible for hypokalaemia because of potassium loss. Dialytic efficiency is central to the maintenance of an acceptable potassium level and the use of a potassium enriched dialysate should be avoided, if not strictly necessary.

**Result**

Vitamin and mineral deficiencies to the patient due to CKD contribute to some complications such as anaemia, cardiovascular disease, and metabolic imbalances. The overall decrease in nutritional intake, dietary restrictions, poor intestinal absorption, inflammatory state, metabolic acidosis, and dialysate losses all put the CKD patient at risk for micronutrient deficiencies [63]. Studies in CKD patients including dialysis and non-dialysis patients show a decrease in the intake of micronutrients such as vitamins, folate, iron, and pantothenic acid [64]. A recent examination of a cohort of children with CKD showed that 28% were deficient in 25 hydroxyvitamin D [65]. Losses of zinc, selenium, folate, iron, and pyridoxine and ascorbic acid during haemodialysis are well documented. Despite the limited intake and dialysate losses of micronutrients, appropriate levels of supplementation of these micronutrients in CKD patients are yet to be clearly determined. For instance, multivitamin supplementations in children on both haemodialysis and peritoneal dialysis have been shown to result in intakes exceeding the recommended daily allowance for these vitamins [63, 64, 66]. The 2009 KDOQI paediatric nutrition guidelines "suggested that supplementation of vitamins and trace elements be provided to children with CKD stages 2–5 if dietary intake alone does not meet 100% of the DRI or if clinical evidence of a deficiency, possibly confirmed by low blood levels of the vitamin or trace element, is present. It is suggested that children with CKD stage 5D receive a water-soluble vitamin supplement" [68]. However, these recommendations are based mostly on limited and low quality evidence and expert opinion. A recent systematic analysis has concluded that there is insufficient evidence to support the routine supplementation of vitamins in patients on haemodialysis and an individualized approach to supplementation is recommended [67].
Discussion

Patients with CKD have to cope with complex modifications to their diet and lifestyle. It is the need of hours that all members of the nephrology team collaborate in evaluating the efficacy of the diet and refers the patient to the dietician as and when required. A renal dietician is central to the nutritional management of CKD patients as He/She will integrate the results of the medical and dietary histories with the nutritional assessment and develop the dietary plan considering the attitudes and preferences of the patient. In some countries specialist renal dietitians are not always available, but it is necessary to ensure that specialist dietary advice can be accessed either from a knowledgeable dietician or nephrologist. Nurses are in the forefront in patient education, support, and screening and information reinforcement.

As nurses are involved in evaluating the efficacy of the treatment and reinforcing all prescriptions including the dietary prescription, it is essential that they have an understanding of basic nutritional principles to stimulate discussions and understanding with patients. Multidisciplinary team work is the keyword for a successful approach to the long-lasting process of adaptation imposed by CKD, which includes important modifications to diet and lifestyle.

Suggestions for Practice

To avoid dietary restrictions impacting too much on a patient’s nutritional status and quality of life, the patient should be instructed on the following strategies:

1. Choose foods low in potassium;
2. Reduce portion sizes and/or frequency of consumption of potassium-rich foods;
3. Use cooking procedures that favour demineralisation.

Boiling vegetables in large volumes of water reduces their mineral content and may be a useful adjunct to a diet low in potassium. The boiled water should not be reutilised because it contains the minerals lost during cooking. Microwave and steam cooking of vegetables should be avoided as foods retain their minerals. Because these techniques induce loss of nutrients other than potassium, the patient’s nutritional status should be continuously evaluated in order to ensure nutritional adequacy.

Conclusion

Patients with CKD have to cope with complex modifications to their diet and lifestyle. It is the dire need that all members of the nephrology team collaborate in evaluating the efficacy of the diet and refers the patient to the dietician and as when required. A renal dietician is central to the nutritional management of CKD patients as He will integrate the results of the medical and dietary histories with the nutritional assessment and develop the dietary plan considering the attitudes and preferences of the patient.

The core responsibility of a dietician is to educate and advise patients by translating scientific information about nutrition into practical advice. Without appropriate assessment and implementation of required nutritional intake of individuals neither of those tasks i.e. goal of nephron protection and effective treatment cannot be accomplished. More over the dietician is also responsible to maintain records of obtained data, findings, suggested actions and outcomes for each patient who provides useful information for the physician and other members of the multidisciplinary team in decision making for further nutritional management and medical treatment of patients.

Authors’ contributions

Ahsan Ilahi and Mo. Usman collected and reviewed the all available information guidelines, reports, and studies. Qazi Zaid Ahmad conceptualized and designed the study. Aziz ur Rahman and Mohammad Rashid drafted and revised the manuscript. All authors read and approved the final manuscript.

References

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