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Nutritional management of chronic renal failure by dietitians – the South African experience

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Objective. The objective of this descriptive study was to assess the practices of South African dietitians regarding the dietary treatment of patients with chronic renal failure.

Subjects and design. A questionnaire was mailed to 600 randomly selected dietitians registered with the Health Professions Council of South Africa. Practices were compared to international standards for pre-dialysis, haemodialysis (HD) and peritoneal dialysis (PD) patients.

Results. A 26% response rate was obtained, with only 28% of these dietitians indicating that they counsel renal patients. The majority of dietitians met the international dietary recommendations, but a substantial number deviated from them. This was especially evident in PD patients, where the deviation ranged from 20% (4 dietitians) in the case of energy and phosphate, to 55% (11 dietitians) in the case of calcium. Parameters used for the assessment of nutritional status included body mass index (45% of dietitians), serum albumin (44%), clinical examinations (43%), bioelectrical impedance (37%) and diet history (36%). Methods used to monitor dietary compliance included biochemistry, dietary history, anthropometric measurements and clinical investigation. The most frequently used approaches in the management of protein-energy malnutrition included supplemental drinks (86%) and dietary enrichment at household level (76%).

Conclusion. Although the majority of dietitians met international standards for most nutrients, there was some variation and uncertainty. Ongoing education will enable South African dietitians to treat renal patients competently and with confidence.

Early nutritional intervention is thought to play a major role in the preservation of renal function and overall well-being in the renal patient.[1] End-stage renal failure requires calorie, protein and micronutrient intake alterations,[2] which may contribute to the high incidence of protein-energy malnutrition (PEM). PEM has been shown to be one of the most important risk factors for increased morbidity and mortality in end-stage renal disease,[3] while ingestion of excessive potassium, phosphorus, sodium and fluid may have adverse effects on fluid balance and result in other complications induced by electrolyte disturbances. Consultation with a renal dietitian to establish an appropriate diet can help to reduce cardiovascular risk factors and mortality risk.[4] Such a diet will also help to prevent malnutrition, anaemia[1] and metastatic calcification of previously undamaged tissue,[5] and may slow the progression of renal disease.[6]

Renal dietitians should be aware of the latest developments in the field of renal nutrition in order to provide optimal care to their patients. However, an international study among 24 countries found that nutritional care varied considerably,[7] despite several publications on evidence- and opinion-based best practice guidelines for nutritional care of renal patients.

In South Africa, patients with early renal impairment are often treated in a primary care setting and are referred to a specialist only late in the course of renal failure. In the last couple of years there has been an increase in the number of private dialysis centres, private hospitals and privately practising dietitians. A dietitian who is not a renal specialist will therefore often have to care for renal patients, and clearly defined and standardised protocols would go a long way towards ensuring optimal dietary management of these patients in South Africa.

Objectives

Primary objective

To obtain information on the dietary practices used by dietitians in the management of patients suffering from chronic renal failure.

Secondary objective

To obtain information on the barriers to successful nutritional management of patients suffering from chronic renal failure.

Methodology

Design

This was a descriptive study performed in 2001.

Population and sample selection

The study population consisted of dietitians dealing with renal patients in South Africa. All dietitians located in major dialysis centres in South Africa, as well as a 50% randomly selected sample of the remaining dietitians registered with the Health Professions Council of South Africa (HPCSA), were included in the initial sample for distribution of the questionnaire (N = 600).

Procedures

An anonymous questionnaire was developed to assess the dietary practices of South African dietitians in the nutritional treatment of patients with chronic renal failure. The questionnaire consisted of structured and open-ended questions covering the dietitian's involvement in counselling of renal patients, dietary prescriptions used, methods used for nutritional assessment and monitoring of compliance, barriers to effective nutrition instruction and methods used in the management or prevention of protein-energy malnutrition. The questionnaire included an instruction sheet, clearly explaining the aims of the study and instructions for completion. The efficacy and face validity of the questionnaire and the instruction sheet were tested on seven 4th-year dietetic students who had experience in the renal units at Tygerberg Hospital and Groote Schuur Hospital. Modifications were made as required. The mailed questionnaires included pre-paid postage and a reminder in order to improve the response. Dietitians were urged to return the questionnaire regardless of whether they saw renal patients or not, to allow us insight into the number of dietitians in South Africa who counsel renal patients.

Analysis

Data were analysed by means of the Microsoft Excel 2000 and Statistica 7 programmes, using descriptive statistics. We used the evidence-based guidelines of the Kidney Disease Outcomes Quality Initiative (K/DOQI)[8] and the American Renal Nutrition Council[9] to compare with the practices of South African dietitians. The Mann-Whitney U-test was used to determine significant differences between dietitians working in the public and private sectors where the data were available and the number of observations was adequate for meaningful comparison. In all other cases the data were combined. Statistical significance was set at $p < 0.05$.

Ethical issues

The study was approved by the Ethics Committee of the Faculty of Health Sciences, University of Stellenbosch. Respondents were ensured of their confidentiality in participation, as response was anonymous, and involvement was voluntary.

Results

A total of 151 dietitians returned the completed questionnaire (response rate 26%). The final sample comprised 43 dietitians who indicated that they counsel renal patients. The majority of these dietitians worked in government hospitals (N = 22), followed by private practice (N = 14) and private clinics (N = 6), with only 1 dietitian being employed by both the private sector and government hospitals.

From the results (Fig. 1) it was clear that dietitians working in government hospitals consulted patients more frequently, i.e. more often on a weekly or monthly basis, than the privately practising dietitians, who consulted patients more often on a monthly to yearly basis ($p < 0.05$). Results (Fig. 2) further showed that dietitians were mostly involved with the dietary management of pre-dialysis patients (N = 39), followed by haemodialysis (HD) (N = 27) and peritoneal dialysis (PD) patients (N = 20). There was no significant difference between dietitians working in government hospitals and privately practising dietitians with regard to the type of patients consulted ($p > 0.05$).

Dietary recommendations used by dietitians

Weight used for calculations. In assessing dietary requirements, 31 dietitians used percentage ideal body weight as the basis for their recommendations. The remaining dietitians used either actual weight or actual dry weight (5 dietitians in each case). A variety of approaches were used to define 'ideal weight'.

Initiation of protein restriction. Various levels of renal function were used as an indication to start protein restriction. Twenty dietitians utilised a glomerular filtration rate (GFR) less than 60 ml/min as the cut-off point, while 6 dietitians indicated that protein restriction was only initiated upon referral by a doctor. A minority of dietitians indicated that they use

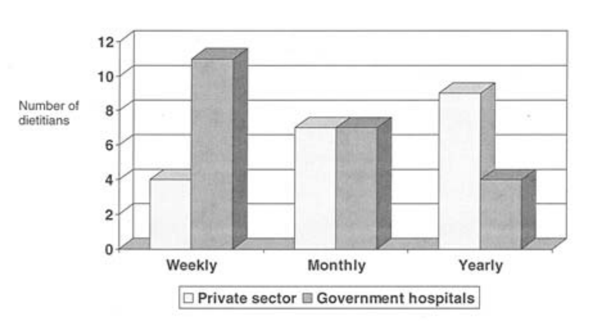

Fig. 1. Frequency with which dietitians counselled patients (significant difference between dietitians working in government hospitals and private sector, $p < 0.05$*).*

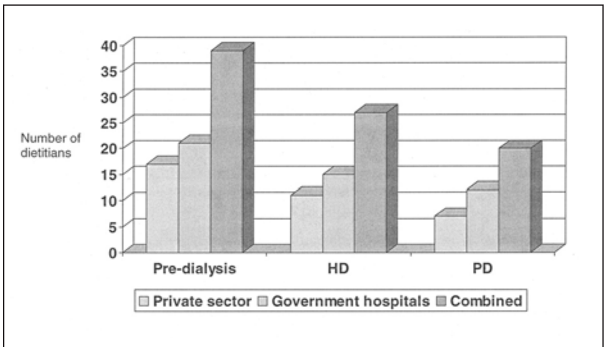

Fig. 2. Categories of renal patients counselled by dietitians (HD = haemodialysis; PD = peritoneal dialysis) (no significant difference between dietitians working in government hospitals and private sector, $p > 0.05$*).*

a GFR of less than 10 ml/min or 25 ml/min, or a serum creatinine of more than 100 µmol/l, 200 µmol/l or 300 µmol/l, as the cut-off point (1 dietitian in each case). Twelve dietitians did not respond to this question.

Dietary recommendations. The percentage of dietitians who met international recommendations for nutrient requirements of renal patients is shown in Table I, together with the recommendations used at the time of the study. Although the majority of dietitians met the international recommendations, a substantial number deviated from them. This was especially evident in PD patients. Throughout, there was a rather high no-response rate.

Vitamin supplementation. Vitamins that were routinely supplemented by the majority of dietitians included vitamin C, vitamin B complex, folate and vitamin B_6 in HD and PD patients (Table II). In pre-dialysis patients less than 20% of dietitians prescribed vitamins on a routine basis.

Exchange lists. Thirty-two dietitians indicated that they use exchange lists for the planning of renal diets, but they were generally unable to indicate the original source. Five dietitians did not respond to this question.

Table I. Comparison of dietitians' and international dietary recommendations for patients with chronic renal failure

	Pre-dialysis (39 dietitians)*					Haemodialysis (27 dietitians)*					Peritoneal dialysis (20 dietitians)*				
		Number of dietitians (% in brackets)					Number of dietitians (% in brackets)					Number of dietitians (% in brackets)			
	Recommended[†]	Match[‡]	Lower	Higher	No response	Recom-mended[†]	Match[‡]	Lower	Higher	No response	Recom-mended[†]	Match[‡]	Lower	Higher	No response
Energy (kJ/kg)	126 - 147	29 (74)	4 (10)	-	6 (15)	126 - 147	17 (63)	8 (30)	-	2 (7)	126 - 147	14 (70)	4 (20)	-	2 (10)
Protein (g/kg)	0.6 - 0.75	33 (85)	1 (3)	2 (5)	3 (8)	≥ 1.2	20 (74)	6 (22)	-	1 (4)	≥ 1.2 – 1.3	14 (70)	5 (25)	-	1 (5)
HBV (%)	≥ 50	20 (51)	2 (5)	12 (31)	5 (13)	≥ 50	16 (59)	3 (11)	7 (26)	1 (4)	≥ 50	10 (50)	2 (10)	7 (35)	1 (5)
Phosphorus (mg/kg)	< 10	19 (49)	1 (3)	14 (35)	5 (13)	< 17	23 (85)	-	-	4 (15)	< 17	13 (65)	2 (10)	2 (10)	3 (15)
Calcium (mg/d)	1 000 - 1500	27 (69)	3 (8)	-	9 (23)	1 400 - 1 600	15 (55)	4 (15)	-	8 (30)	800 - 1 000	3 (15)	-	11 (55)	6 (30)
Potassium (mg/d)[§]	1 500 - 2700	31 (79)	1 (3)	-	7 (18)	2 000 - 3 000	24 (88)	-	-	3 (11)	3 000 - 4 000	10 (50)	7 (35)	-	3 (15)
Sodium (mg/d)[§]	1 000 - 3000	32 (82)	2 (5)	-	5 (13)	1 000 - 3 000	25 (93)	-	-	2 (7)	2 000 - 4 000	10 (50)	2 (10)	5 (25)	3 (15)
Water (ml/d)[§]	Output + (500 - 750)	31 (79)	-	2 (5)	6 (15)	Output + 1 000	20 (74)	-	4 (15)	3 (11)	≥ 2 000	6 (30)	10 (50)	-	4 (20)

* Number of dietitians counselling the different categories of patients.
† Recommendations from the Kidney Disease Outcomes Quality Initiative 2000 (K/DOQI)[9] and the American Renal Nutrition Council 1998.[9] Note that some of these recommendations have changed since the completion of this study.
‡ Number of dietitians meeting international recommendations.
§ Restrict only in cases with complications of decreased excretion.
HBV = high biological value protein.

Table II. Number of renal dietitians prescribing vitamin supplements on a routine basis

Vitamin	Number of dietitians (%)		
	Pre-dialysis (39 dietitians)*	Haemodialysis (27 dietitians)*	Peritoneal dialysis (20 dietitians)*
Vitamin A	0 (0)	1 (4)	2 (10)
Vitamin D	3 (7)	5 (19)	3 (15)
Vitamin E	2 (5)	3 (11)	3 (15)
Vitamin K	1 (2)	0 (0)	1 (5)
Vitamin C	7 (18)	18 (67)	13 (65)
Vitamin B complex	4 (10)	15 (56)	12 (60)
Niacin	5 (13)	8 (30)	8 (40)
Riboflavin	4 (12)	8 (30)	8 (40)
Thiamin	5 (13)	10 (37)	9 (45)
Folate	7 (18)	17 (63)	14 (70)
Vitamin B_6	6 (15)	14 (52)	11 (55)
Multivitamins	3 (7)	3 (11)	4 (20)

* Number of dietitians counselling the different categories of patients.

Barriers to effective nutrition counselling

Aspects identified as barriers to effective nutrition counselling are shown in Fig. 3. Socioeconomic factors were seen as the most important barrier, with lifestyle, motivation and education also playing influential roles.

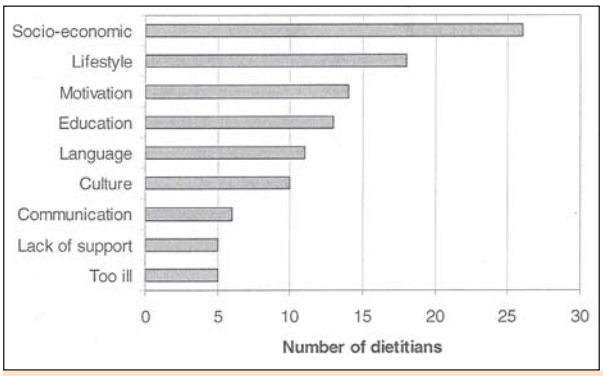

Fig. 3. Barriers to effective nutrition counselling experienced by dietitians.

Methods used in the assessment of nutritional status

Parameters used for the assessment of nutritional status included body mass index (BMI) and serum albumin, used by 19 dietitians on a monthly basis. Clinical examinations (18 dietitians), bioelectrical impedance (16 dietitians) and dietary history (15 dietitians) were the next most frequently used methods of nutritional assessment, also used on a monthly basis. It was also evident that most dietitians used more than one method for nutritional assessment of patients.

Methods used in monitoring of dietary compliance

This question was open-ended, and more than one method was often indicated for each nutritional variable. Methods varied depending on the nutrient involved, but the main methods included biochemistry, diet history, anthropometric measurements and clinical investigation (Table III).

Methods used in the management of PEM

The approaches used in the management of PEM included supplemental drinks (36 dietitians), dietary enrichment at household level (33 dietitians), food parcels and intra-dialytic parenteral nutrition (2 dietitians each).

Discussion

This study has shown that only 28% of registered South African dietitians surveyed were involved in the counselling of renal patients in 2001 and that the

Table III. Methods used by dietitians for monitoring compliance with dietary prescriptions

Nutrient	Number of dietitians (%)			
	Biochemistry	Diet history	Anthropometry	Clinical
Energy	2 (4)	23 (53)	7 (16)	1 (2)
Protein	34 (79)	18 (42)	-	-
Potassium	30 (70)	13 (30)	-	-
Phosphorus	26 (60)	12 (28)	-	1 (2)
Sodium	19 (44)	13 (30)	1 (2)	3 (7)
Water	-	11 (26)	10 (23)	14 (33)

majority of these dietitians worked in government hospitals. Parallel to the increase in private dialysis facilities, which cater mostly for HD patients, one can also expect to see an increase in the number of private dietitians counselling HD patients.

In this study it was found that a variety of approaches were used to define ideal weight. Since the use of actual dry weight to prescribe nutrient intake can be hazardous in the very obese or very undernourished patient, the K/DOQI recommendation is that adjusted oedema-free body weight should be used if actual dry weight is below 95% or more than 115% of the standard body weight as determined from the NHANES II data.[8] For patients whose dry weight is between 95% and 115% of the standard body weight, the actual oedema-free body weight can be used. The adjusted oedema-free body weight allows for the fact that fat mass has lower metabolic needs than lean body mass, and will prevent the overfeeding of very underweight patients.

There was a certain degree of variation regarding the levels of GFR at which protein restriction is initiated. Although many dietitians used a GFR < 60 ml/min as the cut-off point, a substantial number relied on doctors to refer patients for dietary intervention, possibly owing to understaffing of dietitians. A systematic review on the effect of protein restriction on renal function has shown that the combination of protein- and phosphate-restricted diets slows the progression of renal failure in patients with moderate renal failure (GFR 30 - 59 ml/min), and that protein should be restricted to < 0.6 g/kg in pre-dialysis patients (grade A recommendation).[6] For practical reasons, however, the K/DOQI recommendation was set at 0.6 - 0.75 g protein/kg.[8] Although type 2 diabetes mellitus is a major cause of end-stage renal disease,[10] the benefits of protein restriction have not been studied adequately in these patients. In the systematic review the use of protein-restricted diets in diabetic nephropathy was only indicated in type 1 diabetes mellitus (grade A recommendation).[6] The effect of protein restriction was greater in hyperfiltrating patients and independent of glycaemic control. Also, the beneficial effect of the diet was evident before the onset of nephropathy. These findings are supported by a recent randomised controlled trial in which it was concluded that long-term protein restriction is neither feasible nor effective in delaying or preventing renal damage in type 2 diabetes mellitus. It was also found that the initial effect of protein restriction in lowering albuminuria was not sustained over a 12-month period.[10] The level of protein restriction in pre-dialysis diabetic patients is below 0.8 - 1 g/kg.[6] In addition to a beneficial effect on renal function, protein-restricted diets also prevent the build-up of nitrogenous waste products, which may contribute to the development of anorexia.

It is a cause of concern that more than 20% of dietitians prescribed lower amounts of protein for HD and PD patients (6 and 5 dietitians respectively). Dialysis patients require increased amounts of protein, as they may be catabolic and protein leakage may also occur via the dialysate.[11] Minimum requirements to ensure neutral or positive nitrogen balance are based on metabolic studies. Although protein intake less than the prescribed amounts may be able to maintain good protein status in some patients, it is not considered sufficient in the great majority of patients on a diet containing 105 - 147 kJ/kg.[8]

The majority of dietitians used the correct energy prescriptions, but insufficient energy was prescribed by up to 30% of dietitians (N = 8). This may result in the development of a negative nitrogen balance and PEM.[12,13] Metabolic balance studies have shown that the mean energy intake required to maintain neutral nitrogen balance, promote higher serum albumin and anthropometric parameters, and optimise protein utilisation is 147 kJ/kg.[14,15] The K/DOQI recommendation is that, in patients 60 years and older who are assumed to be less active, an energy intake of 126 kJ/kg may be sufficient.[8] In the light of the high prevalence of PEM in patients with renal failure and its association with increased morbidity and mortality, aggressive attempts to meet optimal energy intakes are considered essential. Energy prescriptions are, however, often extremely difficult to meet without energy supplementation, especially in the case of diets containing less than 0.8 g/kg of protein. Creative menu planning, taking a patient's food preferences and socioeconomic circumstances into account, and the use of high-energy density food items should be encouraged whenever possible.

In order to treat abnormal calcium and phosphate metabolism in patients with chronic renal failure, it is necessary to restrict phosphorus intake, use phosphate binders and administer calcium and/or active vitamin D supplements when indicated.[5,9] Phosphate restriction should start early in the course of renal failure (stage 2 or 3).[16] Prescription patterns among dietitians in this study varied, with an alarming number of dietitians prescribing higher amounts of phosphorus in pre-dialysis patients. Complications arising from abnormal calcium and phosphorus balance in patients with chronic renal failure include renal osteodystrophy, calciphylaxis, and soft-tissue calcification. Hyperphosphataemia has also been associated with an increase in hospitalisation rate, premature death, reduced quality of life and increased cost of care.[5,17] Restriction of phosphorus intake is very difficult to achieve without simultaneous restriction of protein intake. Indeed, in large individuals it is impossible to plan palatable diets with optimal amounts of protein while limiting phosphorus intake to less than 1 000 mg/d. Therefore, the recommendations for phosphorus intake increase with protein requirements. Current K/DOQI recommendations state that phosphorus intake should be restricted to 800 - 1 000 mg/d, or as low as

possible while ensuring adequate protein intake. It should be noted, however, that when phosphorus intake exceeds 1 000 mg/d, there is a decrease in the efficacy of phosphate binders, with a dramatic decrease in efficacy at intakes above 1 500 mg/d.[5]

In the case of calcium there was an even greater variation in the response of the dietitians, and prescription was especially problematic in PD patients. This is not surprising, as calcium is the one nutrient for which recommendations seem to keep on changing in search of the best evidence. Current K/DOQI recommendations are that total intake of elemental calcium in stages 3 (moderate renal failure) to 5 (end-stage renal failure) should not exceed 2 000 mg/day, and that the dose of elemental calcium provided by phosphate binders should not exceed 1 500 mg/day,[16] as it may worsen vascular and extra-skeletal calcification. This recommendation is again not evidence based and it is suggested that therapy must be individualised, taking into account vascular risk factors and practical aspects.

Potassium, sodium and water were prescribed correctly by the majority of dietitians in pre-dialysis and HD patients, although in PD patients about half of the dietitians deviated from international recommendations. Controlled intake of potassium is important to prevent complications such as cardiac arrhythmia and sudden death.[18] Controlled intake of sodium and water is necessary to prevent the occurrence of volume-dependent hypertension and complications such as pulmonary oedema, left ventricular hypertrophy and heart failure.[19,20]

Another concern is the relatively large number of dietitians who did not recommend routine supplementation of the water-soluble vitamins in dialysis patients. Dialysis patients are at high risk for deficiencies of several water-soluble vitamins, including vitamin C (< 100 mg/d to prevent oxalosis), folate, pyridoxine, and thiamine owing to losses into the dialysate, poor intake, altered metabolism, and decreased intestinal absorption.[21-23] However, this finding may reflect the fact that vitamin supplements are usually prescribed by the attending doctor in the dialysis unit rather than the dietitian. Vitamin A should not be prescribed on a routine basis in patients with chronic renal failure, as blood levels tend to be elevated owing to decreased degradation of retinol-binding protein by the failing kidneys. Routine supplementation may expose patients to a risk of vitamin A toxicity, especially those with advanced renal failure.[22,23]

Socioeconomic and educational factors were found to be the most significant barriers to nutrition counselling in South Africa owing to a high rate of poverty and illiteracy. Poor household food security contributes to insufficient protein and energy intake, and may be a direct or indirect cause of the poor nutritional status in many South African renal patients.

Bioelectrical impedance analysis is an easy-to-perform method of nutritional assessment with small time investment and high patient acceptance. It was used by a large number of dietitians as part of nutritional assessment, as opposed to the measurement of skinfold thickness, which was only infrequently used. The validity of bioelectrical impedance in renal patients is far from clear, with conflicting reports in the literature,[24,25] and further research is essential for better understanding of its validity. Intradialytic continuous calf multifrequency bioimpedance spectroscopy is a promising new technique that assesses changes in extracellular calf resistance as an indicator of changes in extracellular fluid volume, which may prove useful in predicting dry weight in haemodialysis patients.[26]

The most frequently used approaches in the management of PEM found in this study were the use of food supplements and household enrichment. Other strategies that should be considered include the treatment of reversible causes of anorexia, appetite stimulants, correction of metabolic acidosis, treatment of co-morbid illness, and anabolic hormones.[27]

Shortcomings of this study include the fact that the questionnaire was not able to cover the entire scope of treatment, which would have made it too long. Also, a response rate of only 26% was obtained and the results may therefore not be representative of all renal dietitians in South Africa.

Conclusions

The results indicate that, despite use of the correct recommendations for most nutrients by a large percentage of dietitians, there remains a definite degree of variation and uncertainty regarding the requirements of renal patients. This is supported by an average no-response rate of more than 20%, emphasising a possible high level of uncertainty and lack of confidence among dietitians. Ongoing education and provision of the latest data will enable South African dietitians to treat renal patients competently and with confidence.

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