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RESEARCH

Knowledge, attitude and practices of patients receiving maintenance haemodialysis in Bloemfontein, South Africa

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Introduction: In sub-Saharan Africa, a paucity of data exists in respect of the knowledge, attitudes and practices (KAP) of patients on maintenance haemodialysis (MHD) regarding the dietary adaptations they should make.
Methods: In a descriptive, cross-sectional study, conducted in 2017, questionnaires were administered during structured interviews with 75 participants in five MHD-units in Bloemfontein to assess socio-demographics and KAP regarding the 'renal' diet.
Results: The median age was 50.5 years; 70.7% of participants were male. Overall, 49.4% scored low (< 50%) on knowledge regarding restricted foods, food content of restricted minerals, and phosphate binders; 60.0% reported negative attitudes towards the diet, and 61.4% reported poor adherence practices. Participants with tertiary education (28.0%) had significantly higher knowledge scores than participants with only primary school education (6.7%) (95% CI 3.9%; 73.5%), or those who had only partially completed secondary school (17.3%) (95% CI 6.3%; 64.0%). Only 21.0% reported having received written, and 30.7% verbal, nutrition education in their home language, while 24.0% reported never receiving nutrition education in either their home or second language. Having received nutrition education in a home language and/or second language was associated with significantly higher knowledge scores (95% CI 3.7%; 49.5%). Most (77.3%) reported zero to one consultation with a dietitian per MHD year (NKF-K/DOQI recommends at least three/MHD year).
Conclusion: This population on MHD presented with poor KAP regarding the 'renal' diet, and inadequate involvement of dietitians in their treatment. Receiving nutritional education in a first or second language significantly increased knowledge of, and insight into, the required dietary adaptations.

Keywords dietitian, home language, KAP, maintenance haemodialysis, nutrition education

Introduction

The first meta-analysis to estimate the global prevalence of chronic kidney disease (CKD), published in 2016, concluded that 10–16% of the global population and 8.7% of South Africans have CKD in stages 3–5, based on reported cases.[1] Accordingly, more than five million South Africans[2] may have lost 50% or more of their normal kidney function, which is associated with increased risk of morbidity and premature death.[1] The real prevalence of CKD in South Africa is, however, uncertain due to diagnostic difficulties, particularly in rural areas.[3] Given the high prevalence of hypertension, diabetes and HIV amongst South Africans,[4,5] the actual prevalence of CKD in South Africa is almost certainly higher than reported.[3] Indeed, stage 5 CKD, or end-stage renal disease (ESRD), has been identified as the fifth-highest cause of non-traumatic death in South Africa.[6]

By the end of 2004, an estimated 1 371 million people with ESRD worldwide were receiving renal replacement therapy (RRT) of whom less than 5% were in sub-Saharan Africa.[5,7] Across all regions in the world, maintenance haemodialysis (MHD) is the most common RRT, being used in 89% of cases.[7] At the end of 2016, 8 832 patients were on dialysis in South Africa, and 85.2% of them were receiving MHD.[8]

Patients on MHD are prescribed to adhere to a challenging treatment regimen consisting of numerous daily medications and a 4-hour haemodialysis session twice or thrice per week, supported by specific fluid and dietary restrictions. Thus, the National Kidney Foundation (NKF) recommends that every patient on MHD 'should receive intensive nutritional counselling based on an individualised plan of care developed before or at the time of commencement of MHD therapy'.[9] Investigating whether patients understand these restrictions, how they feel about them, and how well they manage to implement them is, thus, vital to improving dietary compliance in patients on MHD. However, to date, no published studies have investigated this in the South African setting, and only one study has reported on dietary compliance elsewhere in the sub-Saharan region.[10]

By the end of 2016, the South African Renal Registry indicated that 577 patients were receiving RRT in the Free State province, South Africa.[8] Based on the 2016 national trends, around 490 would have been receiving MHD.[8] This study aimed to describe the knowledge, attitudes and practices (KAP) regarding the 'renal diet' of patients receiving MHD in Bloemfontein in the Free State province. The study also investigated the involvement of a dietitian in the treatment of these patients, as well as how socio-demographic factors may be related to the KAP in this population.

Methodology

Study design, study population and sampling

A descriptive, cross-sectional study was performed during 2017, in five of the six dialysis units located in Bloemfontein, which

gave permission. Overall, 175 patients were receiving MHD from these units. Of these, 77 met the inclusion criteria (but only 75 had complete data sets), thus, were ≥ 18 years, were diagnosed with ESRD, had been receiving MHD treatment for at least three months at any of the participating haemodialysis units during the time of data collection from January 2017 to July 2017, and gave informed consent. Anyone hospitalised in the three months before commencement of the study was excluded. Of the 75 participants, 40.0% ($n = 30$) were receiving MHD at tertiary government institutions and 60.0% ($n = 45$) at private institutions.

Approval to conduct the study was obtained from the Health Sciences Research Ethics Committee of the Faculty of Health Sciences at the University of the Free State (UFS) (HSREC142-2016), and the Ethics Committee of the Free State Department of Health. Permission was also obtained from the dialysis unit managers.

Data collection

The researcher developed questionnaires based on an in-depth literature review, including questions on socio-demography (age, gender, education, and home and second language) and KAP regarding dietary adaptations as recommended by the NKF. These were administered in structured interviews with the participants in the dialysis unit during their second or third dialysis session of the week. Knowledge of the applicable dietary restrictions was tested by showing each participant a sequence of 12 pictures of food items commonly eaten in the South African context (based on the South African Renal Exchange Lists[11] in which each patient with ESRD should be educated).

The pictures comprised three high-phosphate foods (> 110 mg PO_4/portion), namely milk, organ meat (liver) and cola drinks and one low-phosphate food (< 100 mg PO_4/portion), namely chicken breast, as control.[11] Three high-potassium foods (> 240 mg K^+/portion), namely potato baked in skin, orange and butternut and one low-potassium food (< 120 mg K^+/ portion), namely an apple, as control.[11] Also, three high-sodium foods (> 400 mg Na^+/portion), namely vienna, instant soup powder and cornflakes, and one low-sodium food (< 100 mg Na+/ portion), namely chilli pepper powder, as control.[11] Participants were asked if each food item shown was allowed in larger (less restricted) amounts or need to be restricted in their diets.[12] An additional option, 'do not know', was included to minimise guessing.[13] They were asked to choose whether the specific food item shown to them was high in either phosphate, potassium, salt (sodium) or 'not high in any of these minerals', or 'do not know'.[11]

Attitudes regarding the recommended dietary adaptations were tested with three questions, asking participants how they felt regarding the dietary restrictions, the type of foods allowed, and the price implication of the 'renal' diet. In each instance, they were required to explain their answers.[12,14]

Similarly, practices were assessed with regard to whether participants were able to consume the restricted food only in the recommended amount, and on how many days per week they generally adhered to the 'renal diet'. Also, if they measured their food portions, whether their families supported them in adhering to the 'renal diet', and how often they ate 'takeaways' (fast foods).[12]

Furthermore, they were asked who taught them about the 'renal diet', and in which language(s) they had received verbal/written nutrition education before (if at all). Participants were also asked if they had ever consulted a dietitian since being on MHD, and, if they had, how often, and if they understood what the dietitian taught them about the 'renal diet'. If they indicated that they understood none or only some of it, they were asked to explain why they thought they did not understand everything. Participants were also asked to identify the phosphate binder medication that they had been prescribed, and how they should use it.

The questionnaires were evaluated for content validity by external, expert renal dietitians.

The questionnaires were translated from English to Afrikaans and Sesotho by experienced bilingual dietitian researchers to ensure reliability. Quality control pre-testing of the questionnaires as advised by Macías and Glasauer[14] was also performed to test validity, ease of administration and participant burden. A pilot study was conducted including one conveniently selected participant from each unit ($n = 5$), who signed informed consent. The pilot sample comprised two English-, one Sesotho- and two Afrikaans-speaking participants to assess possible language barriers with the questionnaires.

Structured interviews were conducted in English or Afrikaans by a single researcher to ensure reliability. When necessary, a registered nurse, employed at the relevant renal unit, was utilised to pose the questions to the participant in Sesotho and interpret their answers in English to the researcher, who noted the responses. Interviews were not scheduled on the first dialysis day of the week when participants are typically fatigued due to the longer inter-dialysis time over the weekend. If a participant did not feel well and up to the task at the scheduled interview time, the interview was rescheduled. Collecting the data during dialysis sessions ensured that the research did not infringe on the participants' time away from dialysis, and did not incur additional travel costs.

Data analysis

The knowledge score was interpreted as the number of correct answers, with > 75% indicating good knowledge, 50–75% indicating average knowledge, and < 50% indicating inadequate knowledge.[12,14] Attitude and practices were not scored but only categorised according to answers. Responses to open-ended questions were grouped according to similar themes.[12]

To calculate the 'number of dietetic visits per year on MHD', the number of visits reported was divided by the number of years on MDH. The dietitian's involvement in the treatment expressed as visits per dialysis year was categorised according to the recommendation of the NKF as insufficient (0–1), average (2–3) or sufficient (> 3).[9,15]

Data were captured onto two separate Microsoft Excel® 2010 datasheets (Microsoft Corp, Redmond, WA, USA) on two separate occasions and were compared by the biostatistician to ensure data integrity. Statistical analyses were performed with the assistance of the Department of Biostatistics (UFS) on SAS® software (version 9.4) (SAS Institute Inc., Cary, NC, USA). Descriptive statistics for categorical data were summarised as frequencies and percentages, and for numerical data as medians and percentiles. Associations were determined by means of 95% confidence intervals (CI) for the median difference or Kruskal–Wallis test for

Table 1: Language spoken by the participants and in which nutrition information had been received ($n = 75$)

	Home language		Second language		Language of written nutrition information received		Language of verbal nutrition information received	
Language	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
English	1	1.3	46	61.4	55	73.4	45	60.0
Afrikaans	18	24.0	7	9.3	14	18.7	23	30.7
Sesotho	35	46.7	14	18.7	4	5.3	6	8.0
Setswana	11	14.7	4	5.3	1	1.3	0	0.0
isiXhosa	9	12.0	3	4.0	0	0.0	1	1.3
isiZulu	1	1.3	0	0.0	0	0.0	0	0.0
Both Setswana and isiZulu	0	0.0	1	1.3	0	0.0	0	0.0
No written nutrition material received					1	1.3		

numerical data and Fisher's exact test for categorical data, with a p-value of < 0.05 considered as statistically significant. As amendments made after the pilot study were minor, these participants' data were included in the final analysis.

Results

Most of the 75 participants were men 70.7% ($n = 53$). The median age of the participants was 50.5 years, ranging from 25 to 78.9 years (41.0 years [lower quartile] and 59.6 years [upper quartile]). Education levels ranged from Grade 4 to postgraduate level, with a median of Grade 12. About a third (28.0%, $n = 21$) had some level of tertiary education, while almost two-thirds (65.3%, $n = 49$) had partially (13 had up to grade 10 only) or fully completed secondary school.

Almost half (46.7%, $n = 35$) of the participants were Sesotho speaking, and 24.0% ($n = 18$) were Afrikaans speaking (Table 1). English was the language in which most written (73.4%, $n = 55$) as well as verbal nutrition information (60.0%, $n = 45$) had been received (Table 1).

About half (54.7%, $n = 41$) of the participants had good knowledge of foods that need to be restricted (Table 2). However, 74.7% ($n = 56$) had poor knowledge regarding the PO_4^-, K^+ and Na^+ content of foods and 58.7% ($n = 44$) did not know the correct way to use phosphate binder medication. One in two (49.4%, $n = 37$) participants had inadequate composite scores for knowledge on foods that need to be restricted, the PO_4^-, K^+ and Na^+ content of the food, and the use of phosphate binders (Table 2).

One in four participants (24.0%, $n = 18$) reported that they had never received written and verbal nutrition education in their home language and/or second language. Participants who had received written and verbal nutrition education in their home language and/or second language had significantly better knowledge scores compared with those that did not (95% CI 49.5%; 3.7%). Participants with tertiary education (diploma, degree and postgraduate degree) (28.0%, $n = 21$), had significantly better composite knowledge scores compared with those with only a primary education (grade 4–7) (6.7%, $n = 5$) (95% CI 73.5%; 3.9%), and partially completed secondary school (grade 8–10) (17.3%, $n = 13$) (95% CI 64%; 6.3%).

Only 40.0% of participants ($n = 30$) reported that they felt positive towards the prescribed eating pattern (Table 3). One in five (21.3%; $n = 16$) felt negative and some of the reasons given included that the food restrictions were too extensive (56.3%, $n = 9$), and that favourite foods were restricted (31.3%, $n = 5$). Other reasons included that they felt the food was tasteless without salt (12.5%, $n = 2$), that usual/typical/traditional

Table 2: Participants' knowledge regarding restricted foods, the mineral content of these foods and phosphate binder medication ($n = 75$)

Classification	Number of participants (*n*)	Percentage (%)
Knowledge of food items (types) that need to be restricted:		
Inadequate (< 50% correct answers)	9	12.0
Average (≥ 50–75% correct answers)	25	33.3
Good (≥ 75% correct answers)	41	54.7
Knowledge of PO_4, K^+ and Na^+ contents of restricted and non-restricted foods:		
Inadequate (< 50% correct answers)	56	74.7
Average (score ≥ 50–75% correct answers)	17	22.7
Good (score ≥ 75% correct answers)	2	2.6
Knowledge regarding phosphate binder medication:		
Inadequate (< 50% correct answers)	44	58.7
Average (≥ 50–75% correct answers)	14	18.7
Good (≥ 75% correct answers)	17	22.7
Composite knowledge scores for the above:		
Inadequate (< 50% correct answers)	37	49.4
Average (≥ 50–75% correct answers)	34	45.3
Good (≥ 75% correct answers)	4	5.3

Table 3: Attitudes of participants towards the 'renal diet' ($n = 70$)

Items	Number of participants (*n*)	Percentage (%)
Feelings about the 'renal diet':		
Positive	30	40.0
Negative	16	21.3
Neutral	29	38.7
Perceived cost of the 'renal diet' compared with a normal diet:		
'Renal diet' is cheaper	11	15.7
'Renal diet' is more expensive	37	52.9
Similar cost diet to the rest of my family	18	25.7
No response to the question	1	1.4
Nobody has explained the 'renal diet' to me	2	2.9
I do not buy anything special; I buy my normal groceries as always	1	1.4
Reported attitude/feelings towards the specific foods allowed on the 'renal diet':		
I like it	39	55.7
I do not like it	11	15.7
Neutral feeling	16	22.9
Nobody has explained to me which food I am allowed to eat or not	4	5.7

foods were restricted (12.5%, $n = 2$), and that social interaction was hindered by food restrictions (12.5%, $n = 2$). Conversely, a reason given for feeling positive about the diet was that participants felt better when they adhered to the 'renal diet' (e.g. not nauseous or swollen) (30.0%, $n = 9$).

Overall, most (52.9%, $n = 37$) felt that the prescribed eating pattern was more expensive compared with the regular diet that the rest of their families were eating (Table 3). A quarter (25.7%, $n = 18$) indicated that they felt that it was similar to what the rest of their families were eating and only 15.7% ($n = 11$) felt that it was cheaper than a regular diet. Participants' reasons for perceiving the 'renal diet' as more expensive than a regular diet included that separate/different/non-traditional foods had to be bought (32.4%, $n = 12$) and that prescribed foods were more expensive than typical/traditional food (29.7%, $n = 11$). A few participants (13.5%, $n = 5$) reported that, in their opinion, some restricted foods[11] were cheaper than prescribed foods (e.g. noting that bananas were cheaper than berries and tinned fish was cheaper than other meat).

About half (55.7%, $n = 39$) reported that they liked the food that they were allowed to eat. Explanations for feeling positive about foods allowed in the 'renal diet' included that eating, in general, was an enjoyable experience (23.1%, $n = 9$); that eating the allowed food had health benefits (18.0%, $n = 7$); and that participants adapted to the required dietary changes (18.0%, $n = 7$) (e.g. 'It is the same food, but with less salt'; 'I became used to eating less steak'). A few (12.8%, $n = 5$) reported that they were positive about the 'renal diet', although noting that they felt no choice but to follow the diet (e.g. 'I have to learn to eat it, whether I like it or not'), and that food was tasteless without salt (2.6%, $n = 1$). Conversely, 15.7% ($n = 11$) said they did not like the food allowed in the 'renal diet' (Table 3). Reasons provided included that food was tasteless without salt (45.5%, $n = 5$), that the number of restricted foods was extensive (leaving limited choices of foods) (18.2%, $n = 2$), and that favourite foods were restricted (18.2%, $n = 2$). The rest of the participants reported neutral feelings.

Most of the participants (61.4%, $n = 46$) reported poor overall adherence to the 'renal diet'. A quarter (25.3%, $n = 19$) had good practices, and the rest (13.3%, $n = 10$) reported average practices. Most participants (61.4%, $n = 46$) indicated that they could only 'sometimes' adhere to the prescribed 'renal diet'. The majority of participants (69.3%, $n = 52$) also reported that their families supported them to follow the prescribed diet, but the rest felt that they were only occasionally (22.7%, $n = 17$) or never (8.0%, $n = 6$) supported. Only 24.0% ($n = 18$) reported that they always measured their food with scales, spoons and cups, while half (53.3%, $n = 40$) indicated that they never did. Moreover, only 26.7% ($n = 20$) of the participants reported that they never bought (ate) takeaway food, while 41.3% ($n = 31$) did so once per week or more often. Additionally, 17.3% ($n = 13$) reported that in the previous week they had not adhered to the 'renal diet' at all; half (52.0%, $n = 39$) reported that they had followed the diet on between one and five days. Less than a third (30.7%, $n = 23$)

Table 4: Practices of participants in adhering to the 'renal diet' ($n = 75$)

Variable	Number of participants (*n*)	Percentage (%)
Are you able to eat the correct amounts of restricted food?		
Always	22	29.3
Sometimes	46	61.4
Never	7	9.3
Does your family support you to follow the correct diet?		
Always	52	69.3
Sometimes	17	22.7
Never	6	8.0
Do you measure your food using scales, and/or different size spoons and cups?		
Always	18	24.0
Sometimes	17	22.7
Never	40	53.3
How many times do you eat takeaways (per month or per week)?		
0 x/month/week	20	26.7
1 x/month (0.25 x/week)	12	16.0
2 x/month (0.5 x/week)	11	14.7
3 x/month (0.75 x/week)	1	1.3
1 x/week	15	20.0
2 x/week	4	5.3
3 x/week	9	12.0
4 x/week	2	2.7
5 x/week	1	1.3
Number of days during the previous week on which you followed the 'renal diet':		
0 days	13	17.3
1 d	5	6.7
2 days	2	2.7
3 days	13	17.3
4 days	11	14.7
5 days	8	10.7
6 days	6	8.0
7 days	17	22.7

reported that they had followed the 'renal diet' on six or seven days of the week (Table 4).

Most participants (84.0%, $n = 63$) had consulted with a dietitian regarding the 'renal diet' at least once; but 16.0% ($n = 12$) had never done so. Most participants (77.3%, $n = 58$) reported having received information regarding the 'renal diet' from dietitians. Other health professionals from whomh participants reported receiving dietary education included nurses (46.7%, $n = 35$), doctors (25.3%, $n = 19$), unit managers (4.0%, $n = 3$), clinical technicians (4.0%, $n = 3$), printed or internet educational materials from trusted sources (17.3%, $n = 13$), and family and friends (14.6%, $n = 11$). Of those who had consulted a dietitian, almost half (47.6%, $n = 30$) (Table 5) reported that they only partially comprehended the nutrition education they had received, citing mostly language barriers as the reason (31.0%, $n = 9$).

Fewer than one in five participants reported that they had had > 3 visits to a dietitian per dialysis year (Table 5) as recommended by the NKF.[9,15] Three-quarters (77.3%) had never or only once consulted a dietitian since being on MHD, despite 64.0% of them being on MHD for longer than two years (information not in table). For those who had consulted with a dietitian, almost half (47.6%, $n = 30$) reported that they did not understand everything explained to them by the dietitian regarding the 'renal diet'. The language barrier was cited as the most common reason (30.0%, $n = 9$), followed by not understanding the advantages and disadvantages of following the 'renal diet' (20.0%; $n = 6$) and that the prescribed foods were not always available or too expensive (20.0%; $n = 6$). Other reasons given by one participant each were that all the information was new, that the contents of reading material had been forgotten, and that it was difficult to comply with the measuring and amounts of food prescribed.

Education level was statistically significantly higher in participants treated in the private sector ($n = 45$) compared with participants treated in the government sector ($n = 30$) (p 0.0031). However, there were no statistically significant differences between the two groups regarding composite knowledge scores (p 0.7042), attitude (p 0.2288), practices (p 0.2202), and the frequency of dietetic involvement (p 0.3007).

Table 5: Involvement of a dietitian in the treatment of participants

Items	Number of participants (n)	Percentage (%)
Number of visits to a dietitian per year on dialysis ($n = 75$):		
Sufficient (> 3 visits per dialysis year)	14	18.7
Average (2–3 visit per dialysis year)	4	3.0
Insufficient (0–1 visit per dialysis year)	58	77.3
Level of comprehension (how much did the participant understand?) ($n = 63$):		
Reported that they understood everything	33	52.4
Reported that they understood some of it, but not all of it	30	47.6
Reported that they understood none of it	0	0.0

Discussion

The current study seems to be the first study to date to focus on the KAP of patients with ESRD on MHD in South Africa concerning the dietary modifications and restrictions recommended by the NKF.[9]

Participants were mostly men, which concurs with a global (as yet unexplained) trend towards fewer women than men receiving RRT,[16] including MHD,[17] even though CKD is more prevalent in women than in men.[1] Very few studies are available for the sub-Saharan region, but similar trends were reported for patients on MHD in single-centre studies in Port Elizabeth (Eastern Cape province, South Africa),[18] and in Cameroon.[10] Likewise, the only South African studies (also cross-sectional and single-centred) involving patients receiving peritoneal dialysis confirmed the same gender trend for RRT.[19,20]

Most participants had average to good knowledge regarding the types of food that they needed to restrict in their diets, which is similar to findings in the UK.[21] However, three in four participants in the current study had inadequate knowledge of the phosphate, potassium and sodium content of certain foods, though the excess of each of these minerals can cause certain side effects.[21] This indicates little insight into the motivation for the restrictions. Notably, according to theSANHANES-1 report, even in the general population very few (only one in five; 22.6%) South Africans had good general nutrition knowledge.[22] Of concern in the current study was that almost three-fifths of participants had inadequate knowledge regarding their phosphate binder medication and/or how to use it correctly. Hyperphosphatemia is one of the common and serious complications of ESRD,[23] and Gago et al.[24] found that the most frequent cause of non-compliance with phosphate binder treatment was the incorrect interpretation thereof.

Participants who had received written and verbal nutrition education in their home language and/or second language had significantly higher knowledge scores compared with those who had not, suggesting that the language of choice for nutrition education may be crucial. With more than 25 languages spoken in South Africa, of which 11 are official, the challenges posed by the language barriers in health care remain under-researched and under-recognised in the South African context.[25] Notably, most participants had received written and/or verbal education on the 'renal diet' in English. While English is commonly accepted as the lingua franca amongst healthcare professionals in South Africa, it is the home language of only 2.9% of the general population in the Free State province,[26] and of less than 2.0% of participants in this study.

Education levels in the current study ranged from Grade 4 to tertiary levels, and participants with a higher education level had significantly better knowledge scores than those with a lower education level. Studies in low- and middle-income countries have identified educational status as a significant predictor of health outcomes.[27] The Dutch Adult Literacy and Life Skills Survey[28] found that one of the underlying mechanisms that drive the relationship between low level of education and poor health is health literacy. Health literacy, in turn, is defined by the US Institute of Medicine as 'the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions'.[28] Verseput and Piccoli[29] recently suggested that nutrition education aimed at the South African patient population with CKD should be posed at the SA school system

grade 5 level. In addition, guidelines can be simplified to a few key messages.[30] The broad scope of education levels represented by the MHD population of the current study highlights that the level of presentation is crucial for designing and executing appropriate nutritional interventions.

In the current study, only two in five participants expressed positive attitudes towards the 'renal diet'. Research shows that if someone scores low on attitude, urgent nutrition-education intervention should be provided for the individual,[14] irrespective of good knowledge. Similar to a US study where 29.0–35.0% of the study population thought that the 'renal diet' interfered with life,[12] participants in the current study explained that foods were tasteless without salt, that too many foods were restricted, including favourites and usual/typical/traditional foods, and that this hindered social interaction. Dietitians are uniquely qualified to take cognisance of these perceived barriers and communicate solutions, not just to patients and caregivers, but also to the whole health professional team. These include culturally and individually acceptable alternatives to favourite foods and/or traditional foods,[31] renal-friendly modifications to recipes for traditional/favourite food, and alternative ways to use spices and herbs to flavour food. Instead of focusing only on which foods need to be restricted, nutrition messages regarding fruits, vegetables and low-cost protein options should focus more on set-portion sizes and limiting the intake frequency rather than avoidance.[12,32] The perceived high cost of the 'renal diet' was also a more prevalent concern in the current study population than in a similar US study, which may be related to the higher levels of poverty and food insecurity in South Africa.[22]

Conversely, nutrition education can also draw on the positive experiences associated with the 'renal diet'[12] highlighted by participants, for example feeling better, e.g. not being nauseous or feeling swollen.

The relationship between dietary adherence and knowledge is controversial as some studies have found a relationship between knowing the restrictions of the diet and adherence, whereas others did not.[12,14,33] The relationships between knowledge and attitude and adherence were not assessed in the current study. Nonetheless, accurate nutrition knowledge may be particularly important when individuals are ready to make dietary changes.[21] Three in five participants reported practices that showed poor adherence to the 'renal diet'. Compared with a similar US study,[12] the current study population reported less frequent takeaway consumption, but less frequent overall adherence to the 'renal diet'.

Almost a third of the participants indicated that their families did not always support them in following the 'renal diet'. Involving the family in nutrition education of the patient may improve attitudes and practices. Moreover, family members, close friends and caregivers (often spouses) should be included in education sessions to strategise social interaction around meals to be inclusive of persons who receive MHD.

Despite the evident need for individualised nutrition education and guidance, three-quarters of the participants in the current study reported insufficient consultation with a dietitian according to NKF recommendations.[9,15] It is noteworthy that 16.0% of these participants had never consulted a dietitian, and a third had consulted a dietitian only once since being on MHD, despite two-thirds of them being on MHD for longer than two years. A UK trial[34] found that frequent consultations with a dietitian (monthly as opposed to once every six months), as well as having a ratio of one dietitian per only 60 patients, improved phosphate control in the short term. Similarly, a Dutch study found that patients who believed that they were receiving insufficient support from professionals, and who lacked confidence in their own capability to manage their disease, experienced more barriers to limiting dietary sodium.[35] Therefore, awareness of the value of dietetic consultation at appropriate frequency (every 4–6 months[9,36]) should be raised amongst medical aids, patients and/or caregivers, nephrologists, nurses and social workers who treat patients on MHD.[9] The suggested dietitian to patient ratio of 1:100 should be mandated by policy-makers to improve the quality of care, as staff shortages could result in insufficient and infrequent dietetic visits.[9,12,15,37]

Limitations

In this study, subtle differences in how participants interpreted the knowledge questions regarding fluids high in phosphates may have introduced some bias. Thus, participants may have identified fluids high in phosphate (milk and cola drinks) correctly as restricted foods based on their knowledge of fluid content and not actually due to the phosphate content as intended. Similarly, as many participants also had diabetes (18.7%, $n = 14$), they may have confused the dietary recommendations of the two conditions. To avoid ambiguity, the sentence 'If you have diabetes mellitus, only consider the following food in terms of minerals (phosphate, potassium, and salt [sodium] content) that need to be restricted/limited in ESRD on haemodialysis, and not according to carbohydrate or sugar content' was included at the beginning of the questionnaire. Regarding phosphate binders, participants were asked to name the phosphate binder medication that they were using. It is, however, possible that they may have known that a certain prescribed tablet needed to be consumed three times per day with meals (and they possibly were compliant), but they may not have known the mechanism/indication of the pill (e.g. that it binds phosphate). Lastly, to assess the involvement of a dietitian, the question 'Why did you not understand (what the dietitian explained to you)?', which was asked to probe for explanations for partial comprehension, may have been too vague. Rephrasing the question, and letting the onus fall on the dietitian, for example 'What could the dietitian have done/said differently to help you understand better?', may have yielded different responses.

Conclusions

Almost half of this population presented with inadequate composite knowledge regarding the several components of the 'renal diet', yet receiving nutritional education in a first or second language was significantly associated with better knowledge. Most participants had neutral to negative attitudes towards the diet and the foods allowed, and they perceived the diet as expensive and challenging to implement. They also reported poor compliance practices and inadequate involvement of dietitians in their treatment.

More research is needed to overcomie the language, cultural and education barriers concerning nutrition education for patients with ESRD. Educational material for patients with ESRD (printed, visual, auditory media, and/or web-based) should be developed and should be contextualised for the South African setting. Beyond merely transferring knowledge, however, the attitudes of patients towards the 'renal diet' should be explored and considered,[14] and practical skills to translate recommendations to compliant practice should be

taught and developed in patients. Additionally, future research should also investigate the impact of more frequent dietetic consultations on metabolic control for patients with ESRD in the South African context.

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