

Registered dietitian nutritionists and perceptions of liberalizing the hemodialysis diet

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BACKGROUND/OBJECTIVES: The objective of this study was to assess the level of awareness, comfort, and likelihood of liberalizing the hemodialysis diet in practicing renal registered dietitian nutritionists (RDN).

SUBJECTS/METHODS: An original, cross-sectional survey was sent to the Academy of Nutrition and Dietetics' Renal Practice Group in May 2017, consisting primarily of renal dietitians.

RESULTS: A total of 187 renal dietitians responded to the survey designed to assess their current practices regarding the renal diet for hemodialysis patients and how comfortable they would be liberalizing the current restrictions. On average, 16.3% of dietitians are extremely likely to liberalize the restrictions on various food groups including fruits and vegetables, beans and legumes, and whole grains.

CONCLUSIONS: RDN feel confident in their ability to interpret and apply evidence-based literature into practice, and they are moderately comfortable liberalizing the renal diet. The participants were generally more comfortable liberalizing the phosphorus restriction than the potassium restriction, and the sodium restriction remains important to control interdialytic weight gain and hypertension. Future research is needed to establish efficacy of a liberalized diet as well as interventions to help RDN feel more comfortable implementing a liberalization of the renal diet.

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INTRODUCTION

Often referred to as the most difficult diet to teach and follow, the diet for end-stage renal disease (ESRD) patients on hemodialysis (HD) recommends restriction of sodium, potassium, phosphorus, and fluids based on individual patient needs. Upon starting HD, patients are educated to follow a dietary plan set forth by the National Kidney Foundation's (NKF) Kidney Disease Outcomes Quality Initiative (KDOQI). The medical nutrition therapy for ESRD currently recommends less than two grams of sodium, three grams of potassium, and one gram of phosphorus per day based on the patient's specific needs [1]. These recommendations result in a restricted diet with minimal options of acceptable foods. According to Khoueiry *et al.*, [2] the restrictive nature of the renal diet is counterintuitive to a generally healthy diet.

The efficacy of the dietary restrictions has been questioned by a number of literature reviews, suggesting a lack of quality empirical support. Notable practices called into question include attempts to control interdialytic weight gain (IDWG) by focusing on fluid intake rather than sodium, lack of separation between organic and inorganic phosphorus, and potentially overly restricting potassium [3-6]. Specifically, a focus on fluid

intake rather than thirst may result in patient compliance challenges with an attempt to ignore thirst rather than decreasing the initial signal to consume fluid [3]. Restricting organic phosphorus [4-5] and potassium may not have a clear relationship with circulating levels [6]. This dietary prescription results in a very small list of acceptable foods, resulting in a barrier for patients to successfully comply. Indeed, the movement toward liberalization is partially fueled by a need to promote a more heart-healthy intake profile in patients who are already at a higher risk of CVD, the leading cause of death in ESRD [7]. However, these guidelines have been the standard for many years, and dietitians and other healthcare professionals may be hesitant to liberalize the dietary recommendations due to lack of knowledge of the recent research, or they may be skeptical of changing their practice.

Extensive research has been carried out to understand if health professionals, such as Registered Dietitian Nutritionists (RDN) and nurses, stay current on emerging research. Commonly reported barriers include time, resources, and support [8-10]. Even if practitioners do stay current with the literature they may be unaware of the body of evidence or lack thereof in support of the renal diet. Regardless, it is important to note that the NKF's KDOQI guidelines do currently recommend the conservative

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restrictions [1].

Currently, thorough research has not been completed to determine if nutrition professionals working with HD patients feel comfortable changing their practices based on emerging literature. The purpose of this investigation was to determine the likelihood of RDN staying current on evidenced-based research and applying this knowledge to their practice, specifically related to medical nutrition therapy of ESRD utilizing HD. This study aimed to answer the following research questions: 1. How confident are practitioners in their ability to stay current on research? 2. How often do RDN recommend that their patients consume fruits and vegetables, whole grains, and beans and legumes despite their potassium and phosphorus content? 3. How comfortable do practitioners feel liberalizing the HD diet?

SUBJECTS AND METHODS

Survey development

The objectives of this study were assessed through a cross-sectional survey. The survey, titled Assessing Professional Perceptions of the Renal Dietary Restrictions Questionnaire, was formatted online using Select Survey software (ClassApps, Version: v4.162.022). A team of professionals involved in HD care and/or research reviewed the survey, including three RDN and four researchers with expertise in survey validation, HD, and/or statistics. Each individual was asked to evaluate the questionnaire for possible misinterpretation and conciseness. Further, individuals were asked to identify the construct, corresponding to the three previously listed research questions, to which each question applied. The first two items on the survey address practitioners' utilization of evidence based practice (EBP), with questions investigating either practitioners' current practices or feelings toward liberalizing the renal diet. EBP questions were adapted from the Evidence-Based Practice Profile Questionnaire [11]. The following items asked participants to rate their likelihood to recommend or avoid various foods, food groups, or nutrients of frequent concern and concluded with an assessment of the practitioners' views on liberalizing the renal diet. This tool also collected information on demographics including age, years as a RDN, years in renal practice, gender, ethnicity, highest degree obtained, and main area of practice.

Sample

The Academy of Nutrition and Dietetics (AND) approved the survey prior to distribution through the Renal Practice Group (RPG), where RDN members working primarily with HD patients were asked to participate. The AND's Dietetic Practice Group manager coordinated distribution. The survey was initially distributed in May 2017 via a weekly electronic newsletter to the approximately 2,136 RPG members receiving emails. One week later, a follow-up reminder was sent through the same newsletter, and the survey remained open for an additional two weeks. Participants were provided with a consent form at the beginning of the questionnaire, and those who did not give consent were then directed to the end of the survey. All procedures were approved by the Illinois State University Institutional Review Board (1190437-3).

Statistical analysis

The responses to each question were analyzed using the IBM SPSS Statistics 23 software to assess relationships between perceived ability to interpret EBP, current practice, and level of comfort to liberalize the HD diet. Missing data were not included in calculating the average responses for each question. Regression analysis was used to statistically evaluate if various responses could predict the outcome of how comfortable the sampled RDN felt liberalizing the diet. Demographic data was utilized to characterize the sampled population and also assessed using regression analysis and chi square tests to measure relationships between years in practice, highest degree obtained, and feelings toward liberalizing the diet.

RESULTS

Sample

A total of 187 RDN working primarily with HD patients participated in this survey, equating to an estimated 9% response rate. The average age of the participants was 51 ± 13 years with 24 ± 13 years of practice as an RDN and 15 ± 11 years of renal practice. The majority, 74%, work in an outpatient dialysis center. Table 1 outlines the demographic characteristics of survey participants.

Table 1. Demographics of a cohort of renal registered dietitian nutritionists

	Mean \pm SD
Age (yrs)	50.56 \pm 13.36
Years as RDN	24.44 \pm 13.21
Years in renal practice	14.72 \pm 11.20
	n = 187 (%)
Gender	
Male	5 (2.7)
Female	162 (86.6)
Did not answer	20 (10.7)
Ethnicity	
Caucasian	155 (82.9)
Hispanic or Latino	5 (2.7)
African American	2 (1.1)
Native American or American Indian	0 (0)
Asian/Pacific islander	3 (1.6)
Other	1 (0.5)
Did not answer	21 (11.2)
Highest degree obtained	
Bachelors	73 (39.0)
Masters	91 (48.6)
Doctorate	6 (2.7)
Did not answer	18 (9.6)
Main area of practice	
Outpatient family	1 (0.5)
Inpatient/Acute care	10 (5.3)
Outpatient dialysis center	139 (74.3)
Community-based agency	1 (0.5)
Other	17 (9.1)
Did not answer	19 (10.2)

RDN: Registered Dietitian Nutritionists

Table 2. Responses to how renal Registered Dietitian Nutritionists feel about their ability to find and apply evidence-based research

	Likert scale rating (%) [*]					Mean ± SD
	Not confident at all	A little confident	Somewhat confident	Quite confident	Very confident	
Confidence finding/reviewing EB [#] literature (n = 185)	0.5	2.7	23.2	43.8	29.7	3.99 ± 0.83
Confidence applying current research to individual cases (n = 186)	0	4.8	24.2	43.5	27.4	3.94 ± 0.84

	Likert scale rating (%) [^]					Mean ± SD
	Not at all familiar	Slightly familiar	Moderately familiar	Very familiar	Extremely familiar	
Familiarity with current trends suggesting liberalization of the renal diet (n = 187)	5.8	9.9	29.7	33.7	20.9	3.54 ± 1.11

* Likert scale: 1 = Not confident at all; 2 = A little confident; 3 = Somewhat confident; 4 = Quite confident; 5 = Very confident

[#] Evidence-based

[^] Likert scale: 1 = Not at all familiar; 2 = Slightly familiar; 3 = Moderately familiar; 4 = Very familiar; 5 = Extremely familiar

Table 3. Responses of renal Registered Dietitian Nutritionists and their current practices regarding the renal diet

	Likert scale rating (%) [*]					Mean ± SD
	Never	Rarely	Sometimes	Often	Always	
Recommend whole grain products (n = 183)	2.7	13.1	45.4	30.1	8.7	3.29 ± 0.90
Recommend dairy products (n = 180)	2.8	24.4	51.1	16.1	5.6	2.97 ± 0.86
Differentiate between organic and inorganic P (n = 181)	4.4	6.1	16.6	34.3	38.7	3.97 ± 1.10
Recommend beans and legumes (n = 182)	2.7	17.0	56.6	21.4	2.2	3.03 ± 0.77
Recommend avoiding inorganic P (n = 183)	1.1	1.6	6.6	33.3	57.4	4.44 ± 0.78
Recommend avoiding organic P (n = 184)	3.8	16.8	56.5	19.6	3.3	3.02 ± 0.81
Recommend avoiding high K ⁺ fruit and vegetables without history of hyperkalemia (n = 180)	6.1	22.8	46.1	20.0	5.0	2.95 ± 0.94
Recommend avoiding high K ⁺ fruit and vegetables with history of hyperkalemia (n = 180)	0	1.1	13.9	42.8	42.2	4.26 ± 0.74
Discuss sodium content of processed foods (n = 180)	0	0.6	9.4	48.9	41.1	4.31 ± 0.66
Discuss that thirst is caused by eating salty foods (n = 177)	0	0	15.8	50.5	33.3	4.18 ± 0.68
Recommend ignoring thirst to adhere to fluid restriction (n = 180)	18.9	31.1	35.6	13.9	0.6	2.46 ± 0.97
Recommend lowering Na ⁺ intake rather than strictly limiting fluids (n = 178)	1.1	12.4	29.8	36.5	20.2	3.62 ± 0.98
Recommend strictly limiting fluids rather than lowering Na ⁺ intake (n = 177)	23.2	41.8	26.6	8.5	0	2.20 ± 0.89
Recommend whole foods rather than processed foods to reduce Na ⁺ and/or inorganic P additives (n = 179)	0.6	1.1	7.8	51.4	39.1	4.27 ± 0.70

* Likert scale: 1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Very often; 5 = Always

Evidence-based practice

Participants were asked to rate their confidence level regarding perceived ability to locate and review evidence-based literature with a Likert scale corresponding to 1 as "not confident at all," to 5 indicating "very confident." The mean response was 4.0 ± 0.8. When asked about their confidence level in ability to apply current research findings to individual cases, the mean response was 3.9 ± 0.8. The distributions of these responses are outlined in Table 2. The final question of the survey assessed the participants' familiarity with current trends in the literature suggesting liberalization of the renal diet with 1 meaning "not familiar at all" and 5 indicating "extremely familiar." The average response was 3.5 ± 1.1.

There was no significant relationship between the participants' perceived ability to find evidence based literature and their position on organic phosphorus in the diet. However, there were significant but weak relationships between the ability to find literature and their level of comfort toward liberalizing the phosphorus ($r = 0.16$, $P = 0.04$) and potassium restrictions ($r = 0.18$, $P = 0.02$). The participants' perceived ability to apply literature in their practice was not significantly related to their

feelings towards liberalizing organic phosphorus ($r = 0.03$, $P = 0.70$), phosphorus in general ($r = 0.08$, $P = 0.30$), or potassium ($r = 0.11$, $P = 0.15$).

Regression analyses showed that neither the participants' confidence in their ability to find literature or their ability to interpret literature were good predictors of how the participant felt about liberalizing organic phosphorus considering favorable micronutrient and fiber profiles of these food sources ($P = 0.38$, $R^2 = 0.01$). These variables were not significant predictors of how the participant felt about incorporating more whole grains, beans, legumes, and nuts in the diet despite the phosphorus amounts ($P = 0.10$, $R^2 = 0.03$). In addition, these variables were not significant predictors of the participants' comfort level toward liberalizing the potassium restriction ($P = 0.07$, $R^2 = 0.03$). However, the participants' perception of their ability to apply research findings was a statistically significant but weak predictor of familiarity with current trends in the literature suggesting liberalization of the renal diet ($P = 0.01$, $R^2 = 0.14$).

Current practices

Responses from the questions regarding current practices can

Table 4. Renal Registered Dietitian Nutritionists' views of liberalizing the current renal dietary restrictions

	Likert scale rating (%) [*]					Mean ± SD
	Extremely unlikely	Unlikely	Neutral	Likely	Extremely likely	
Instruct patients that it is acceptable to "liberalize" standard restrictions on fresh fruits and vegetables (n = 176)	0	13.6	33.0	38.1	15.3	3.55 ± 0.91
"Liberalize" standard restrictions on beans and legumes (n = 176)	0	13.1	28.4	44.9	13.6	3.59 ± 0.88
"Liberalize" standard dietary restrictions on whole grain products (n = 176)	1.1	10.2	22.7	46.0	19.9	3.73 ± 0.93
	Likert scale rating (%) [^]					Mean ± SD
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
"Organic P consumption is acceptable when considering the favorable micronutrient and fiber profile of these foods and the relatively low bioavailability of organic P." (n = 173)	1.2	2.3	15.0	53.2	28.3	4.05 ± 0.79
"I feel comfortable liberalizing the P restriction of the renal diet to include more whole grains, beans, legumes, and nuts to increase fiber, micronutrient, an antioxidant intake." (n = 173)	0.6	9.8	19.1	48.6	22.0	3.82 ± 0.91
"I feel comfortable liberalizing the K+ restriction of the renal diet to include more fruits, vegetables, whole grains, beans, and legumes to increase fiber, micronutrient, and antioxidant intake." (n = 173)	2.3	19.1	33.5	36.4	8.7	3.30 ± 0.95

^{*} Likert scale: 1 = Extremely unlikely; 2 = Unlikely; 3 = Neutral; 4 = Likely; 5 = Extremely likely

[^] Likert scale: 1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree

be found in Table 3. Multiple regression analysis showed that the response to questions regarding recommending beans and legumes, avoiding inorganic phosphorus, and avoiding organic phosphorus were significant predictors of how likely the participants were to liberalize the standard restriction on these types of foods ($P < 0.001$, $R^2 = 0.39$). The frequency with which participants recommend patients consume whole grain products was a significant predictor of how strongly they felt about accepting organic phosphorus in the renal diet ($P < 0.001$, $R^2 = 0.29$).

Views of liberalizing HD dietary restrictions

Table 4 shows the responses from all questions regarding views of liberalizing the HD diet. Familiarity with current trends in the literature regarding liberalization of the renal diet was a good indicator of how strongly participants agreed with the statements considering the acceptability of organic phosphorus consumption ($P < 0.001$, $R^2 = 0.13$). This was also a significant predictor of comfort level toward liberalizing the phosphorus restriction ($P < 0.001$, $R^2 = 0.20$) and liberalizing the potassium restriction ($P < 0.001$, $R^2 = 0.13$). Years in renal practice was not a significant predictor of the participants' willingness to liberalize the potassium restriction, ($P = 0.74$) with $R^2 = 0.00$, or the phosphorus restriction ($P = 0.35$) with $R^2 = 0.01$.

DISCUSSION

A total of 43% of participants felt "quite confident" in their ability to find interpret, and apply literature to their practice while a minority, responded "not confident at all" or "a little confident," indicating that overall, RDN perceived themselves to be able to understand current literature related to practice. The EBP questions in this research agree with prior findings in similar professionals in that the majority appreciates the importance of reading literature, though this study did not ask the RDN for specific barriers.

In regards to knowledge of current literature, the average response was between "moderately familiar" and "very familiar" with trends to liberalize the renal diet. The level of familiarity with this topic could be a positive sign for change, though some RDN responded with less than "moderately familiar." This survey did not investigate reasons why RDN may not be familiar with the emerging trend to liberalize the renal diet. Previous research may indicate reasons and barriers to explain these findings [8-10,13]. Regardless, the KDOQI guidelines remain the standard of nutritional care in this population. Until recommendations change, RDN may rightfully hesitate to make more liberal dietary prescriptions. Further, RDN need support from physicians. Metcalfe *et al.* [12] emphasized the importance of physician support, and without this, renal RDN may hesitate to modify their practice.

Results from this study indicate that confidence related to interpreting and applying literature were significant predictors of participants' familiarity with the topic of liberalizing the HD diet. Perhaps those who felt confident in their ability to find and interpret information are more likely to stay abreast of the literature as a whole and, consequently, are more aware of the state of the science.

The majority of this investigation assessed current practices involving recommendations to consume or avoid foods or food groups commonly addressed in the renal diet. HD RDN are more likely to recommend avoiding high-potassium fruits and vegetables if the patient has a history of hyperkalemia; however, some RDN recommend avoiding these foods even without a history of hyperkalemia. The risk is that RDN may be overly restrictive towards fruits and vegetables resulting in a loss of the additional benefits associated with these whole foods. Several studies have indeed shown that serum potassium is not significantly correlated with dietary potassium intake in the HD population, indicating that excessive restrictions may be unnecessary for some patients [9,14]. Furthermore, potentially over-restrictive counseling to limit potassium-rich foods may

exacerbate hypertension along with missing important micronutrients and fiber [2,15-17].

The majority of participants reported “sometimes” recommending avoidance of whole grains, beans, and legumes. The response to this question was also predictive of how comfortable the RDN felt incorporating organic sources of phosphorus in the diet found in these same food sources. Over half of the participants reported they always recommend avoiding inorganic phosphorus, though others continue to recommend avoiding organic sources of phosphorus regularly. While controversial, bioavailability of phosphorus may differ, with estimates of inorganic forms being nearly 100% absorbed and a more modest 60% of organic. Therefore, the micronutrient profile and fiber content of these foods may outweigh the concerns about its potentially low bioavailable phosphorus [18]. Similar to fruits and vegetables, patients may be unnecessarily limited in their intake of whole grains, beans, and legumes, and suffering from a lack of their otherwise positive nutrient profile [18].

Results of this study indicate that RDN are more likely to recommend limiting sodium as opposed to fluids to manage IDWG. Most RDN also recommend whole foods rather than processed foods to limit sodium and inorganic phosphorus additives. These practices align with research by Carrigan *et al.*, [19] which concluded that diets higher in processed foods, and in turn higher in food additives, contain 60% higher total phosphorus and sodium amounts than low-additive foods. Multiple studies [20-23] demonstrate the relationship between fluid and sodium restrictions concluding that patients with very low sodium intake can control IDWG and hypertension better than those patients with higher sodium intakes and stricter fluid intakes. The findings of this study suggest a positive trend in sodium education, particularly considering the cardiovascular stress associated with large IDWG.

The final research question investigated RDN's overall likelihood to liberalize the renal diet. Responses showed that not all RDN are ready for this change in practice. Only 15% of participants reported they felt it was acceptable to liberalize the standard restriction on fruits and vegetables, and 14% of responders said the same about the bean and legume restriction. Similarly, 20% were extremely likely to liberalize the whole grain restriction. Many participants did not have an opinion either way, selecting the “neutral” response. This suggests that RDN are not yet prepared to move to a more liberal dietary pattern for HD patients. Several participants, however, did note that they did not feel they should rate their comfort level any higher as they felt that each patient will require individualized levels of restrictions based on personal biochemical assessments.

Limitations of this study include the relatively high level of education of the participants and the fact that one diet cannot be suitable for every patient. Certainly, liberalizing the current HD dietary restrictions must be in combination with clinical judgement for individual patients. The sampling objective of this investigation was to specifically target dietitians practicing in a HD setting, which drove the rationale for recruiting through AND RPG; however, this could have resulted in a biased sample. Further, not all renal RDN are members of the AND RPG and 9% is a low response rate. The primary strength of this report is the evaluation of the current state of practice among HD

RDN. The participants were from a variety of backgrounds including years of practice and location, and this likely created a more accurate depiction of the renal RDN population.

This research brings attention to the lack of significant evidence to support the current renal diet guidelines. This should affect the direction of future research, continuing education of RDN, and patient education. It is important to note that randomized controlled trials are needed to evaluate the safety and clinical outcomes of a more liberal renal diet, and until this evidence is available, renal RDN practice should proceed on an individualized basis and generally follow KDOQI guidelines. Overall, HD RDN have divergent opinions on whether fruit and vegetables, beans and legumes, and whole grains should be included in the renal diet. The fact that many are in favor of these additions, on a patient-by-patient basis, could have significant, positive influences on individual nutrient intake. This has the potential to lead to enhanced patient quality of life and decreased severity of co-morbidities, as mentioned previously. Specifically, patients could benefit from these changes by increasing heart-healthy food choices and decreasing complications due to inadequate intakes [2-3,24]. Further, this work can influence future studies, including clinical trials, to improve the renal diet and, possibly, promote changes to the standardized ESRD diet prescription to benefit overall health for the HD population.

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CONFLICT OF INTEREST

The authors declare no potential conflicts of interest

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