Registered dietitian nutritionists and perceptions of liberalizing the hemodialysis diet

Alyssa L. Welte, Tammy Harpel, Julie Schumacher and Jennifer L. Barnes §
Department of Family and Consumer Sciences, Illinois State University, Normal, 61790, IL, United States

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.

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...
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).

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

| Demographic Category                      | n = 187 (%) | Mean ± SD     |
|------------------------------------------|-------------|---------------|
| Age (yrs)                                | 50.56 ± 13.36 |
| Years as RDN                            | 24.44 ± 13.21 |
| Years in renal practice                  | 14.72 ± 11.20 |
| 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

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.
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 4.0 ± 0.8. 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 participants felt about liberalizing organic phosphorus considering favorable micronutrient and fiber profiles of these food sources (P = 0.38, R² = 0.01). These variables were not significant predictors of how the participants felt about incorporating more whole grains, beans, legumes, and nuts in the diet despite the phosphorus amounts (P = 0.10, R² = 0.03). In addition, these variables were not significant predictors of the participants’ comfort level toward liberalizing the potassium restriction (P = 0.07, R² = 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, R² = 0.14).

Current practices
Responses from the questions regarding current practices can

Evidence-based practice
Participants were asked to rate their confidence level regarding perceived ability to find and apply evidence-based research 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, R² = 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, R² = 0.03). In addition, these variables were not significant predictors of the participants’ comfort level toward liberalizing the potassium restriction (P = 0.07, R² = 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, R² = 0.14).

Current practices
Responses from the questions regarding current practices can

Evidence-based practice
Participants were asked to rate their confidence level regarding perceived ability to find and apply evidence-based research 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, R² = 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, R² = 0.03). In addition, these variables were not significant predictors of the participants’ comfort level toward liberalizing the potassium restriction (P = 0.07, R² = 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, R² = 0.14).

Current practices
Responses from the questions regarding current practices can

Evidence-based practice
Participants were asked to rate their confidence level regarding perceived ability to find and apply evidence-based research 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, R² = 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, R² = 0.03). In addition, these variables were not significant predictors of the participants’ comfort level toward liberalizing the potassium restriction (P = 0.07, R² = 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, R² = 0.14).

Current practices
Responses from the questions regarding current practices can

Evidence-based practice
Participants were asked to rate their confidence level regarding perceived ability to find and apply evidence-based research 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, R² = 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, R² = 0.03). In addition, these variables were not significant predictors of the participants’ comfort level toward liberalizing the potassium restriction (P = 0.07, R² = 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, R² = 0.14).

Current practices
Responses from the questions regarding current practices can
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 RDNs 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.

ACKNOWLEDGEMENTS

The authors would like to thank Dr. Caroline Mallory, Dr. Myoung Kim, Dr. Kenneth Wilund, Ms. Deborah Fairrow, and Ms. Kristin Weins for their critical review of the survey as well as the renal dietitians who participated in this research.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest

ORCID

Alyssa L. Welte: https://orcid.org/0000-0002-4001-8796
Tammy Harpel: https://orcid.org/0000-0003-0069-1879
Julie Schumacher: https://orcid.org/0000-0002-1903-6375
Jennifer L. Barnes: https://orcid.org/0000-0002-2029-059X

REFERENCES

1. Eknoyan G, Levin A, Levin NW; National Kidney Foundation. K/DOQI clinical practice guidelines for bone metabolism and disease in chronic kidney disease. Am J Kidney Dis 2003;42 Suppl 3:S1-201.
2. Khoueiry G, Waked A, Goldman M, El-Charabaty E, Dunne E, Smith M, Kleiner M, Lafferty J, Kalantar-Zadeh K, El-Sayegh S. Dietary intake in hemodialysis patients does not reflect a heart healthy diet. J Ren Nutr 2011;21:438-47.
3. Biruete A, Jeong JH, Barnes JL, Wilund KR. Modified nutritional recommendations to improve dietary patterns and outcomes in hemodialysis patients. J Ren Nutr 2017;27:62-70.
4. Calvo MS, Uribarri J. Contributions to total phosphorus intake: all sources considered. Semin Dial 2013;26:54-61.
5. Noori N, Sims JJ, Kopple JD, Shah A, Colman S, Shinaberger CS,
Bross R, Mehrrotra R, Kovesda CP, Kalantar-Zadeh K. Organic and inorganic dietary phosphorus and its management in chronic kidney disease. Iran J Kidney Dis 2010;4:89-100.

6. St-Jules DE, Goldfarb DS, Sevick MA. Nutrient non-equivalence: does restricting high-potassium plant foods help to prevent hyperkalemia in hemodialysis patients? J Ren Nutr 2016;26:282-7.

7. United States Renal Data System. 2016 USRDS Annual Data Report: Epidemiology of Kidney Disease in the United States. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2016.

8. Burrowes JD, Russell GB, Rocco MV. Multiple factors affect renal dietitians’ use of the NKF-K/DOQI Adult Nutrition Guidelines. J Ren Nutr 2005;15:407-26.

9. Hall-McMahon EJ, Campbell KL. Have renal dietitians successfully implemented evidence-based guidelines into practice? A survey of dietitians across Australia and New Zealand. J Ren Nutr 2012;22:584-91.

10. Johnston B, Coole C, Narayanasamy M, Feakes R, Whitworth G, Tyrell T, Hardy B. Exploring the barriers to and facilitators of implementing research into practice. Br J Community Nurs 2016;21:392-8.

11. Metcalfe C, Lewin R, Wisher S, Perry S, Bannigan K, Moffett JK. Barriers to implementing the evidence base in four NHS therapies: dietitians, occupational therapists, physiotherapists, speech and language therapists. Physiotherapy 2001;87:433-41.

12. McEvoy MP, Williams MT, Olds TS. Evidence based practice profiles: differences among allied health professions. BMC Med Educ 2010;10:69.

13. Hand RK, Steiber A, Burrowes J. Renal dietitians lack time and resources to follow the NKF KDOQI guidelines for frequency and method of diet assessment: results of a survey. J Ren Nutr 2013;23:445-9.

14. Noori N, Kalantar-Zadeh K, Kovesda CP, Murali SB, Bross R, Nissenson AR, Kopple JD. Dietary potassium intake and mortality in long-term hemodialysis patients. Am J Kidney Dis 2010;56:338-47.

15. Gallen IW, Rosa RM, Esparaz DY, Young JB, Robertson GL, Batlle D, Epstein FH, Landsberg L. On the mechanism of the effects of potassium restriction on blood pressure and renal sodium retention. Am J Kidney Dis 1998;31:19-27.

16. Kalantar-Zadeh K, Tortorici AR, Chen JL, Kamgar M, Lau WL, Moradi H, Rhee CM, Streja E, Kovesda CP. Dietary restrictions in dialysis patients: is there anything left to eat? Semin Dial 2015;28:159-68.

17. Morris RC Jr, Sebastian A, Forman A, Tanaka M, Schmidlin O. Normotensive salt sensitivity: effects of race and dietary potassium. Hypertension 1999;33:18-23.

18. Wilkens KG, Juneja V, Shanaman E. Medical nutrition therapy for renal disorders. In: Mahan LK, Escott-Stump S, Raymond JL, editors. Krause’s Food and Nutrition Care Process. 13th ed. St. Louis, MO: Elsevier Saunders; 2012. p.799-831.

19. Carrigan A, Klinger A, Choquette SS, Luzuriaga-McPherson A, Bell EK, Darnell B, Gutiérrez OM. Contribution of food additives to sodium and phosphorus content of diets rich in processed foods. J Ren Nutr 2014;24:13-9.

20. Rigby AJ, Scribner BH, Ahmad S. Sodium, not fluid, controls interdialytic weight gain. Nephrol News Issues 2000;14:21-2.

21. Chazot C. Opinion: can chronic volume overload be recognized and prevented in hemodialysis patient? Semin Dial 2009;22:482-6.

22. Charra B, Chazot C, Jean G, Laurent G. Long, slow dialysis. Miner Electrolyte Metab 1999;25:391-6.

23. Kayikcioglu M, Tumuklu M, Ozkahya M, Ozdogan O, Asci G, Duman S, Toz H, Can LH, Basci A, Ok E. The benefit of salt restriction in the treatment of end-stage renal disease by haemodialysis. Nephrol Dial Transplant 2009;24:956-62.

24. Roy LG, Shetty MS, Urooj A. Effect of nutritional intervention on malnutrition indicators in patients on haemodialysis. J Ren Care 2013;39:39-46.