ORIGINAL RESEARCH

An Analysis of the Effects of Predictive Early Nutritional Care Interventions in Patients Undergoing Maintenance Haemodialysis

Lingyan Pan, BS; Rui Cao, BS; Sujin Zhou, BS; Mingmei Peng, MM; Jie Huang, BS; Shuting Xu, MM; Song Zou, AD; Yuli Yang, BS

ABSTRACT

Objective • To study the effect of predictive early nutritional care intervention on gastrointestinal function, Subjective global nutritional assessment (SGA) score, serum albumin (ALB) and high-sensitivity C-reactive protein (hs CRP), quality of life and quality of sleep in patients on maintenance haemodialysis.

Methods • A total of 90 cases of maintenance hemodialysis patients in our hospital were collected from March 2020 and randomly divided into two groups of 45 cases each. The control group was cared for according to routine procedures. The study group added predictive early nutritional care intervention to this control group, i.e., nutritional personalized care was adjusted according to the patient's own disease, adherence, and comorbidities. The nursing effects, improvement of gastrointestinal function, and serum indexes when the two groups were compared.

Results • Before the intervention, there was no difference between the two groups regarding the improvement of gastrointestinal function, pg-sga score, or serum indexes ($P > .05$). After the intervention, the gastrointestinal function, pg-sga score and serum indexes in the two groups were improved, and the calorie and protein intake, the total effective rate of gastrointestinal function improvement, ALB level and quality of life score in the control group were significantly lower than those in the study group; BMI, AC, and TSF were significantly higher compared with study group; The level of hs CRP and sleep quality score in the study group were smaller than those in the study group ($P < .05$).

Conclusion • Through predictive early nutritional care intervention, maintenance hemodialysis patients can increase food intake and improve protein and calorie intake. In turn, it effectively improves gastrointestinal function, malnutrition and microinflammation, and improves life and sleep, which is worthy of clinical promotion. (*Altern Ther Health Med.* 2025;31(1):316-320).

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INTRODUCTION

Maintenance hemodialysis is one of the effective treatment methods for patients with uremia and end-stage renal disease, which can prolong the survival time of patients.[1] Hemodialysis is a widely used blood purification method in clinics. It has high safety and easy operation. However, patients who need maintenance hemodialysis treatment usually have poor physical conditions and are prone to complications. Their gastrointestinal function will be suppressed to a certain extent, resulting in protein metabolism disorder and malnutrition, which is not favoring the patient's prognosis and physical health. Therefore, to strengthen the prognosis, early nutritional nursing is particularly important. Relevant studies show that,[2,3] early nutritional nursing intervention for maintenance hemodialysis patients can successfully promote immunological function, improve nutritional status, and enhance quality of life. Based on this, this study compares predictive early nutritional nursing intervention for patients on maintenance hemodialysis in our hospital from March 2020 to July 2021.

METHODS

General Information

This was a randomized controlled trial (RCT) study design. We selected a total of 90 patients who underwent maintenance hemodialysis from March 2020 to July 2021 in our hospital. They were randomly divided into two groups of

45 cases each. The control group included 29 males and 16 females ranging in age from 39 to 57 years, with an average age of (48.00 ± 2.13) years, a history of 1 to 10 years, with an average history of (5.50 ± 0.24) years, and dialysis 1 to 3 times per week, with an average of (2.00 ± 0.09) times per week. The study group consisted of 26 men and 19 women, ranging in age from 41 to 59 years, with an average age of (50.00 ± 2.22) years, a history ranging from 1 to 12 years, and dialysis performed 2 to 3 times per week, with average (2.50 ± 0.11) times a week. The basic data of patients in both groups were not statistically significant ($P > .05$) and were comparable. The study was approved by the Human Ethics Committee of the First Affiliated Hospital of Jinan University (Ethical Review Acceptance No. 202001), and each patient signed an informed consent to participate in the study.

Inclusion and Exclusion Criteria Inclusion criteria: (1) patients were dialyzed more than twice a week; (2) Informed and signed consent form by patients and their families; (3) Informed hospital ethics committee approval.

Exclusion criteria: (1) those with severe digestive tract diseases or diabetes; (2) Other malignant tumors; (3) Persons with mental or cognitive impairment.

Methods of Care

All patients were fully dialyzed, 2 ~ 3 times / week, 4h / time. Erythropoietin (2500IU) was injected subcutaneously for 2 ~ 3 times / week. On this basis, the control group carried out nursing according to the routine process, gave patients a comfortable environment and psychological nursing, and carefully observed the signs and indicators of patients. On this basis, the study group added predictive early nutritional nursing intervention. Specific methods: (1) according to the patient's personal education level and mastery of disease knowledge, explain the correct dietary and nutritional needs to enhance the patient's awareness of self-management and correctly understand the relationship between dietary nutrition and prognosis. (2) Record the patient's personal nutritional status, understand their dietary and nutritional intake, confirm the causes of the patient's nutritional imbalance, calculate the nutritional demand per day according to the patient's personal body and malnutrition, assist and urge the patient and his family members to formulate and implement recipes. Nutritional requirement standard: generally, the daily calorie intake of dialysis patients is 96.4 ~ 113kj / (kg·d). We should eat less and more meals and encourage more eating. Polysaccharide foods accounting for 56% ~ 61% of the total calories are supplemented every day to reduce triglycerides and blood glucose in patients; Protein supplement 1.3 ~ 1.4g / (kg·d), mainly high-quality protein, such as lean meat, milk, eggs, etc; Fat supplement was 1g / (kg·d). Ask patients to eat more green vegetables, eat less bean food and products as much as possible, and avoid high potassium and high phosphorus foods, such as mushrooms, corn, bananas, etc. Let patients eat a certain amount of fruit every day to ensure their vitamin intake. Salt intake depends on urine volume; Urine volume < 500ml / D, salt intake 1 ~ 2G / D; Urine volume > 500ml / D, salt intake 3 ~ 4G / D; The water intake is suitable according to the weight increase of less than 1kg / d. (3) Adjust according to the patient's compliance, complications, personal economic conditions, and eating habits, and try to achieve individualized nursing. Print the food composition table and send it to each patient for reference. The patients in both groups received standard continuous intervention for three months.

Observation Indicators

(1) The gastrointestinal function of the two groups was recorded and counted every day. The evaluation standard refers to the grading standard of the gastrointestinal symptom rating scale (GSRS)[4] Grade 0 means no obvious reaction; Grade I indicates slight nausea and vomiting; Grade II refers to occasional vomiting, with vomiting times of 1 ~ 3 times / D; Grade III indicates frequent vomiting symptoms requiring treatment, with vomiting times of 4 ~ 6 times / D; Grade IV indicates frequent vomiting and inability to eat, with vomiting times of 7 times or more / D.

(2) The two groups adjusted their dietary protein and calorie intake for 7 consecutive days before and 6 months after the intervention, respectively. The variety and quantity of food in each meal by special personnel, and then carried out the grade. The egg white matter and calories consumed by each patient were calculated with reference to the food composition table,[5] and the pg-sga evaluation index,[6] namely the skin fold thickness of triceps brachii (triceps skin fold thickness (TSF), arm circumference (AC) and body mass index (BMI).

(3) Carefully observe and record the improvement of gastrointestinal function after operation and accurately evaluate the levels of serum albumin (ALB) and plasma highly sensitive C reactive protein (hs CRP).[7,8] The prognosis of all patients was fasting for 8h. 3ml of elbow vein blood was taken in the morning of the next day, centrifuged at a speed of 3500r · min-1 for 15min, with a radius of 13.5cm. After taking the supernatant, the serum ALB level was detected by immunoturbidimetry and the plasma hs CRP level was detected by fluorescence immunoluminescence, which were operated in strict accordance with the specifications. ALB level < 55g / L and > 35g / L, indicating normal; hs CRP level 1 ~ 1 0mg / L is normal. Higher level of hs CRP is associated with more severe inflammation and prognosis.

(4) Quality of life; Patients were scored by Medical Outcomes Study Short Form 36 (SF-36)[9], including physiology, cognition, emotion, daily life, social function, nausea and vomiting, appetite, and overall health status. Higher life quality is indicated by the score that is nearer 100.

(5) Sleep quality: Before the intervention, 1 and 3 months after intervention, the sleep status were scored by Pittsburgh sleep quality index (PDQI), respectively.[10] Lower life quality is indicated by a score that is nearer 21.

Statistical Methods

Data were statistically analyzed using SPSS 18.0 software. Measurement information was expressed as (±s) using the

independent samples *t* test, and count information was expressed as % using the χ^2 test. $P < .05$ was taken to mean that the difference was statistically significant.

RESULTS

Comparison of protein and calorie intake between the two groups of patients

Before the intervention, the two groups had no significant difference in calorie or protein intake ($P > .05$). After the intervention, protein and calorie intake was significantly higher in the study group than in the control group ($P < .05$) (Shown in Table 1.). Suggests that predictive early nutritional care interventions can be effective in improving patients' nutritional intake.

Comparison of the improvement of gastrointestinal function between the two groups of patients

Table 2 and Figure 1 show the gastrointestinal function scores of the two groups of patients after the intervention. After the intervention, the gastrointestinal function score of the patients in the study group (43 points) was significantly higher than that of the control group (37 points) ($P < .05$), suggesting that nutritional care intervention helps to improve the gastrointestinal function of the patients.

Comparison of pg-sga evaluation index between the two groups of patients

Both groups' pg-sga evaluation indexes were nearly the same before the intervention. After the intervention, the indicators in both groups showed an upward trend. The BMI, AC and TSF indicators of the study group were significantly better than the control group were better ($P < .05$) (Shown in Table 3).

Comparison of serum indicators between the two groups

Pre-intervention, both the study and control groups' serum indexes were almost no different ($P > .05$). The reference range of ALB concentration in adults is about 35-50 g/L. After the intervention, there was an increase in ALB in both groups, which was significantly higher in patients in the study group (35.71±4.29) than in those in the control group (32.43±4.14) ($P < .05$), suggesting that the patients in the study group recovered to the normal range more quickly. There was a decrease in hs-CRP in both groups after the intervention, and hs-CRP was significantly higher in patients in the control group (6.09±1.06) than in the study group (4.13±0.25) ($P < .05$), suggesting that the patients in the study group could effectively improve the occurrence of microinflammation. (shown in Table 4).

Comparison of quality of life and quality of sleep between the two groups

Before the intervention, there was no difference in the two group's quality of life and sleep ($P > .05$). After the intervention, the two groups' quality of life and sleep both improved. The study group's quality of life score was greater than the control group's, while its sleep quality was lower. ($P < .05$) (Shown in Table 5).

Table 1. Protein and calorie intake in two groups ([n,($\bar{x} \pm s$)])

Group	n	protein[g/(kg·d)]		calories [kJ/(kg·d)]	
		Before intervention	After intervention	Before intervention	After intervention
Control	45	0.89±0.13	0.96±0.18	110.09±13.6	112.91±12.24
Research	45	0.84±0.12	1.21±0.19	109.79±12.18	140.82±17.61
t	-	1.856	6.408	0.110	8.730
P value	-	.061	.000	.913	.000

Table 2. The improvement of gastrointestinal function in two groups [n, (%)]

group	n	Level 0	Level I	Level II	Level III	Level IV	Total effective rate
control group	45	17 (37.78)	14 (31.11)	6 (13.33)	5 (11.11)	3 (6.67)	37 (82.22)
Research Group	45	32 (71.11)	7 (15.56)	5 (11.11)	1 (2.22)	1 (2.22)	43 (95.56)
χ^2	-	-	-	-	-	-	4.050
P value	-	-	-	-	-	-	.044

Figure 1. The improvement of gastrointestinal function grade in two groups

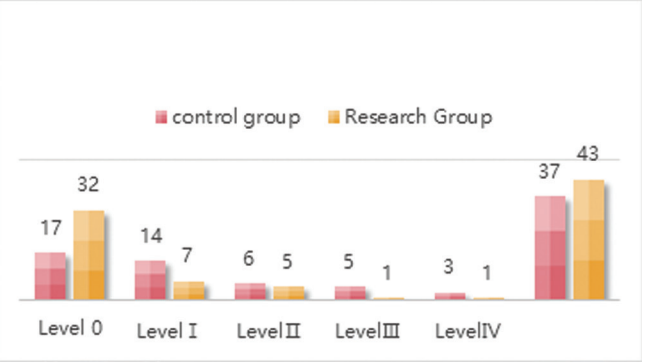

Table 3. pg-sga evaluation indexes in two groups [n,($\bar{x} \pm s$)]

group	n	BMI (kg/m²)		AC (cm)		TSF (cm)	
		Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
control group	45	19.26±4.28	20.31±4.37	20.44±4.59	20.59±4.68	0.96±0.30	1.03±0.31
Research Group	45	19.15±4.19	22.37±4.92	20.41±4.52	22.67±4.98	0.94±0.32	1.21±0.48
t	-	0.123	2.100	0.031	2.042	0.306	2.113
P value	-	.902	.039	.975	.044	.760	.037

Table 4. ALB and hs CRP indexes in two groups [n,($\bar{x} \pm s$)]

group	n	ALB (g/L)		hs-CRP (mg/L)	
		Before intervention	After intervention	Before intervention	After intervention
control group	45	29.72±3.74	32.43±4.14	6.89±0.38	6.09±1.06
Research Group	45	29.68±3.69	35.71±4.29	6.91±0.42	4.13±0.25
t	-	0.051	3.691	0.237	12.017
P value	-	.959	.000	.813	.000

Table 5. Sleep quality and quality of life scores in two groups ($\bar{x} \pm s$)

group	n	PSQI(fraction)		QLQ-C30(fraction)
		1 month after intervention	3 months after intervention	After intervention
control group	45	15.11±2.59	11.69±2.18	33.12±2.75
Research Group	45	12.38±2.43	7.03±1.52	46.16±2.17
t	-	5.157	11.763	24.971
P value	-	.000	.000	.000

DISCUSSION

China is increasingly becoming an ageing country.[1] The incidence rate of uremia and terminal terminal nephropathy is increasing year by year, so the number of patients needing maintenance hemodialysis is increasing. Although the current hemodialysis technology is gradually mature and safe, patients

are at risk for complications during maintenance hemodialysis , such as electrolyte imbalance, nutrient loss, sleep disorder, etc. malnutrition is more common, and its trend is to develop in the direction of worse and worse quality of life and physical quality in the long run.[11] Many studies shows that patients' nutritional condition, immunity, and quality of life can all be considerably improved by dietary nursing interventions for maintenance hemodialysis patients.[12] However, there are few studies on the effects of early nutritional nursing intervention on ALB, hs CRP and sleep quality of maintenance hemodialysis patients. Therefore, nutritional nursing intervention become a highly promising technique in reducing complications and improving patients' malnutrition and life quality. In this study, in order to study the effect of predictive early nutritional care intervention on maintenance hemodialysis patients, the improvement of gastrointestinal function, pg-sga evaluation index, serum index, quality of life and quality of sleep was analyzed. The results of this study proved that predictive early nutritional care intervention can effectively improve the digestion and absorption, life and sleep quality of maintenance hemodialysis patients, and also improve microinflammation, reduce the complication rate and improve the prognosis.

We found that the total effective rate of protein and calorie intake and improvement of gastrointestinal function in the study group were significantly better than those in the control group ($P < .05$). Thus, predictive early nutritional nursing intervention for maintenance hemodialysis patients can effectively improve protein and calorie intake and significantly improve gastrointestinal function's discomfort. The reason may be that after the individualized diet intervention, the patients correctly realized the relationship between diet nutrition and prognosis, improved their diet compliance, and effectively improved the prognosis of the patients.[13,14] By comparing the efficacy of early enteral nutritional care with traditional care for patients with severe acute pancreatitis, Xiao et al. found that early nutritional care can effectively improve the level of inflammation in patients.[15] Our results showed that both groups' pg-sga evaluation and serum indexes were improved after the intervention, however, the levels of hs CRP were considerably higher than those in the study group, while the levels of BMI, AC, TSF, and ALB were significantly lower in the control group. ($P < .05$). Hs CRP is a C-reactive protein in plasma. Many studies show[16,17] that during the clinical treatment of maintenance hemodialysis, if the body stimulates the monocyte-macrophage system due to toxins and microorganisms in the body for a long time, the level of hs CRP will increase the generation and occurrence of micro-inflammation and reduce the prognostic effect. Other studies have shown that adequate nutritional status is important for maintaining proper immune system function, and that a sensible, healthy, nutritious diet may have a direct impact on inflammation.[18] The results of this study suggest that predictive early nutritional nursing intervention in maintenance hemodialysis patients can effectively improve malnutrition and micro-inflammation. The reason may be that the patients in the study group ate strictly according to their personal conditions and nutritional needs, and the daily intake of calories and protein increased appropriately, which was superior to that in control one, dramatically alleviated patient malnutrition, improved life quality and enhanced their immunity, so as to reduce the level of hs CRP and improve micro-inflammation, Improve the prognosis.[19,20]

This study found that although both groups' quality of life and sleep dramatically enhanced after the intervention, the study group's improvement in both areas was noticeably greater than the control group's ($P < .05$). It demonstrates that predicted early nutritional nursing intervention for maintenance hemodialysis patients can significantly improve patients' quality of life and sleep. The reason may be that maintenance hemodialysis patients are in the process of long-term dialysis, resulting in the body in a very low state and serious complications such as low blood pressure and anemia. The continuous early nutritional care for patients, assisting patients with individualized diet, ensuring the intake of daily nutritional needs of each patient, improving and maintaining patients' normal blood pressure and reducing the incidence of complications.[21,22] It demonstrates that maintenance hemodialysis patients can effectively alleviate complications, reduce their incidence, improve their quality of life and sleep, and effectively improve their pg-sga evaluation index, ALB, and hs CPR levels through predictive early nutritional nursing intervention.

CONCLUSION

The study compared the effects of routine care and predictive early nutritional nursing intervention on maintenance hemodialysis patients and found that the predictive early nutritional nursing intervention significantly improved patients' nutritional intake, gastrointestinal function, microinflammation, quality of life and quality of sleep. This is of great significance in reducing the complication rate and improving the prognosis of patients on maintenance hemodialysis, etc., and is worthy of further clinical promotion. And our findings can provide data and theoretical references for other researchers and healthcare professionals to continue exploring the benefits of early nutritional care interventions in different settings and patient populations. However, this study has some limitations:(1) it was a retrospective study; (2) the sample size was small and included only one hospital. The efficacy of predictive early nutritional care interventions in other patients may be further explored in the future, and we believe that predictive early nutritional care interventions have very high potential to improve patient prognosis.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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None.

STATEMENT OF ETHICS

This study was approved by the Ethics Committee approval of the First Affiliated Hospital of Jinan University (202001). Signed informed consent were also obtained from all participants.

CONSENT FOR PUBLICATION

The work described has not been published previously.

REFERENCE

1. Zhang Z, Yin D, Chen H, et al. Evaluation of anemia, malnutrition, mineral, and bone disorder for maintenance hemodialysis patients based on bioelectrical impedance vector analysis (BIVA). [J]. *Clin Exp Nephrol*. 2020;24(12):1162-1176. doi:10.1007/s10157-020-01945-1
2. Yang XM, Li QM, Gao QN. Effect of high-quality nursing intervention on anxiety and depression in patients with chronic heart failure companied malnutrition: A protocol for systematic review and meta-analysis. [J]. *Medicine (Baltimore)*. 2020;99(22):e20261. doi:10.1097/MD.0000000000020261
3. He W, Bi Y, Xu H, Gao L, Zhao X. Analysis and Nursing Health Education of Current Status of Maintenance Hemodialysis Patients with Hyperphosphatemia [J]. *Journal of Advances in Medicine Science*. 2020;3(2):31-33. doi:10.30564/jams.v3i2.1895
4. Usta M, Ersoy A, Ayar Y, et al. Comparison of endoscopic and pathological findings of the upper gastrointestinal tract in transplant candidate patients undergoing hemodialysis or peritoneal dialysis treatment: a review of literature. [J]. *BMC Nephrol*. 2020;21(1):444. doi:10.1186/s12882-020-02108-w
5. Coelho KS, Giuntini EB, Grande F, et al. 12th IFDC 2017 special issue – Brazilian Food Composition Table (TBCA): development and functionalities of the online version [J]. *J Food Compos Anal*. 2019;84:103287. doi:10.1016/j.jfca.2019.103287
6. Desbrow B, Bauer J, Blum C, Kandasamy A, McDonald A, Montgomery K. Assessment of nutritional status in hemodialysis patients using patient-generated subjective global assessment. *J Ren Nutr*. 2005;15(2):211-216. doi:10.1053/j.jrn.2004.10.005
7. You L, Wang X, Wang W. A Novel Substrate-Inspired Fluorescence-Based Albumin Detection Improves Assessment of Clinical Outcomes in Hemodialysis Patients Receiving a Nursing Nutrition Intervention. *Med Sci Monit*. 2021;27:e930257. doi:10.12659/MSM.930257
8. Basol M, Goksuluk D, Sipahioglu MH, Karaagaoglu E. Effect of Serum Albumin Changes on Mortality in Patients with Peritoneal Dialysis: A Joint Modeling Approach and Personalized Dynamic Risk Predictions. *BioMed Res Int*. 2021;2021:6612464. doi:10.1155/2021/6612464
9. Ethier I, Nevis I, Suri RS. Quality of Life and Hemodynamic Effects of Switching From Hemodialysis to Hemodiafiltration: A Canadian Controlled Cohort Study. *Can J Kidney Health Dis*. 2021;8:20543581211057717. doi:10.1177/20543581211057717
10. Derya Ister E, Citlik Saritas S. The Effect of Acupressure on Daytime Sleepiness and Sleep Quality in Hemodialysis Patients. *Holist Nurs Pract*. 2021 Mar-Apr 01;35(2):71-80. doi:10.1097/HNP.0000000000000436
11. Zhou M, Du Y, Wu Y, Zhang P, Liu P, Li J. Analysis of inflammatory factor levels in serum and risk factors in patients with chronic renal failure undergoing maintenance hemodialysis. *Am J Transl Res*. 2021;13(6):6994-7000.
12. Rozga M, Burrowes JD, Byham-Gray LD, Handu D. Effects of Sodium-Specific Medical Nutrition Therapy from a Registered Dietitian Nutritionist in Individuals with Chronic Kidney Disease: An Evidence Analysis Center Systematic Review and Meta-Analysis. *J Acad Nutr Diet*. 2021 Apr 30:S2212-2672(21)00227-6.
13. Gurlek Demirci B, Carrero JJ, Tutal E, Bal Z, Sezer S. Effect of nutritional support on nutritional status and inflammation in malnourished patients undergoing maintenance hemodialysis. *Hemodial Int*. 2021;25(4):532-540. doi:10.1111/hdi.12936
14. Daniel SC, Azuero A, Gutierrez OM, Heaton K. Examining the relationship between nutrition, quality of life, and depression in hemodialysis patients. *Qual Life Res*. 2021;30(3):759-768. doi:10.1007/s11136-020-02684-2
15. Xiao Q, Lang L, Ma Z, et al. Exploration of the Curative Effect of Early Enteral Nutrition Nursing on Patients with Severe Acute Pancreatitis and the Improvement of Patients' Mental Health and Inflammation Level[J]. *Journal of Healthcare Engineering*, 2021, 2021.
16. Naseri-Salahshour V, Sajadi M, Nikbakht-Nasrabadi A, Davodabady F, Fournier A. The effect of nutritional education program on quality of life and serum electrolytes levels in hemodialysis patients: A single-blind randomized controlled trial. *Patient Educ Couns*. 2020;103(9):1774-1779. doi:10.1016/j.pec.2020.03.021
17. Vijaya KL, Aruna M, Narayana Rao SVL, Mohan PR. Dietary Counseling by Renal Dietician Improves the Nutritional Status of Hemodialysis Patients. *Indian J Nephrol*. 2019;29(3):179-185. doi:10.4103/ijn.IJN_272_16
18. Di Giosia P, Stamerra CA, Giorgini P, Jamialahamdi T, Butler AE, Sahebkar A. The role of nutrition in inflammaging. [J]. *Ageing Res Rev*. 2022;77:101596. doi:10.1016/j.arr.2022.101596
19. Jo IY, Kim WJ, Park HC, Choi HY, Lee JE, Lee SM. Effect of Personalized Nutritional Counseling on the Nutritional Status of Hemodialysis Patients. *Clin Nutr Res*. 2017;6(4):285-295. doi:10.7762/cnr.2017.6.4.285
20. Hendriks FK, Kooman JP, van Loon LJC. Dietary protein interventions to improve nutritional status in end-stage renal disease patients undergoing hemodialysis. *Curr Opin Clin Nutr Metab Care*. 2021;24(1):79-87. doi:10.1097/MCO.0000000000000703
21. Li J, Hou G, Sun X, Chen A, Chai Y. A Low-Cost, Intradialytic, Protein-Rich Meal Improves the Nutritional Status in Chinese Hemodialysis Patients. *J Ren Nutr*. 2020;30(2):e27-e34. doi:10.1053/j.jrn.2019.03.084
22. Naseri-Salahshour V, Sajadi M, Nikbakht-Nasrabadi A, Davodabady F, Fournier A. The effect of nutritional education program on quality of life and serum electrolytes levels in hemodialysis patients: A single-blind randomized controlled trial. *Patient Educ Couns*. 2020;103(9):1774-1779. doi:10.1016/j.pec.2020.03.021