Oman Medical Journal [2019], Vol. 34, No. 2: 137-146

# Effect of Consultation and Follow-up Phone Calls on Biochemical Indicators and Intradialytic Weight Gain in Patients Undergoing Hemodialysis

Nasrin Hanifi, Leila Salimi Ezzat and Mohammadreza Dinmohammadi*

*School of Nursing and Midwifery, Zanjan University of Medical Sciences, Zanjan, Iran*

ARTICLE INFO

***Article history:***
Received: 1 March 2018
Accepted: 22 October 2018

***Online:***
DOI 10.5001/omj.2019.26

***Keywords:***
Consultation; Follow-up Studies; Hemodialysis; Biochemical Markers; Intradialytic Weight Gain.

ABSTRACT

***Objectives:*** We sought to determine the effect of consultation and follow-up phone calls on biochemical indicators and intradialytic weight gain (IWG) in patients undergoing hemodialysis. ***Methods***: We conducted a double-blind, randomized clinical trial of 86 patients undergoing hemodialysis in Iran. Patients were grouped through convenience sampling and randomly allocated into two groups. The experimental group had face-to-face consultations, and each patient was given a monthly diet. Next, over 12 weeks, we conducted 28 follow-up phone calls. In both groups, biochemical indicators and IWG were measured at baseline, and in the fourth, eighth, and twelfth weeks of the study. ***Results:*** The results showed that calcium and IWG indices in the fourth, eighth, and twelfth week, and phosphorus and potassium and IWG indices in the eighth and twelfth weeks had statistically significant differences between the experimental and control groups ($p < 0.050$). ***Conclusions:*** In our study, consultation and follow-up phone calls in hemodialysis patients result in improved biochemical indicators. Therefore, in patients undergoing hemodialysis, consultation and follow-up phone calls are recommended to improve patient's biochemical indicators.

End-stage renal disease (ESRD) is a chronic disease that can induce major problems in patients and health systems.[1] In these patients, due to impaired renal function, electrolytes (except calcium) accumulate in the body and their excretion is reduced.[2] Salt, water, and phosphorus retention following secondary hyperparathyroidism are the main problems that these patients experience.[3]

Hemodialysis is the most common treatment method for ESRD.[4] Successful hemodialysis depends on four factors: adherence to diet, adherence to medication, fluid intake limitation, and regular attendance at hemodialysis sessions.[3] However, the ability to adapt to dietary restrictions, control fluids intake, and timely medication use are very difficult for hemodialysis patients[5] so that their ability to self-manage is less than ideal.[6]

There are several ways to monitor treatment adherence in hemodialysis patients. One method is through indirect criterion such as self-reporting.[7] However, self-reporting criteria are biased because patients often exaggerate their adherence.[8] One way of evaluating objectively is to use direct criteria such as serum levels of biochemical indicators (sodium, potassium, calcium, phosphorus, nitrogen, urea) and intradialytic weight gain (IWG).[9] Nonadherence to the recommended sodium intake is measured by IWG or intradialytic weight loss because excessive dietary intake of sodium causes thirst and consequently leads to fluid nonadherence.[10] Moreover, nonadherence to the drug regimen (phosphate inhibitor) increases the serum level of phosphate, which plays an important role in the development of secondary hyperparathyroidism.[3]

Nonadherence to the treatment plan is one of the major challenges in hemodialysis patients.[5] This issue leads to disease progression, prolonged hospitalization, increased costs, complications, and mortality.[11] Poor adherence forces nurses to offer professional consultations. One study has shown patients tend to consult with the medical team, and are satisfied with the provided training.[12] In some studies, various educational and consultative interventions by nurses or nutritionists, either individually or collectively, through verbal methods or films have been shown to improve treatment adherence.[13,14] Another study has shown that educational and behavioral interventions

*Corresponding author: ✉mdinmohammadi@zums.ac.ir

can help patients change their behavior and increase treatment adherence.[15]

Nurses are the most influential individuals in increasing treatment adherence.[16] By performing health counseling, nurses seek the reasons for nonadherence allowing them, together with patients, to apply an appropriate policy to promote adherence.[17] One study suggested that counseling would be more effective when nurses follow-up with patients consistently.[16] Follow-up and continuity are essential measures in the successful implementation of each program. Continuity in maintaining health programs leads to cooperation, adherence, awareness, and sensitivity promotion. As a result, in addition to creating a dynamic care relationship, access to the patient would be possible.[18]

Frequent contacts with renal nurses and individual education can help patients solve problems, set goals, and manage their disease better.[19] Phone contact is a useful method to follow-up chronic disease. Follow-up phone calls make nurses a good source of support to increase patients adherence.[20] Telecommunications facilitate the mutual relationship between patients and care providers and obviate the need for prolonged hospitalization.[21] Phone contacts and nursing consultations in most chronic diseases can improve treatment adherence, reduce the incidence of disease complications, increase quality of life, and decrease the duration of hospitalization.[16,20]

The literature review of increased treatment adherence in patients undergoing hemodialysis reveals that each patient applies a specific educational intervention.[13–15] In some chronic diseases, the effectiveness of continuous follow-up has been confirmed.[16,20,22] However, less attention has been paid to the use of face-to-face counseling and frequent follow-up in hemodialysis patients to control biochemical indicators and IWG.

This study was designed to assess the effect of consultation and follow-up phone calls on biochemical indicators and IWG in patients undergoing hemodialysis.

## METHODS

This double-blind quasi-experimental study had an experimental group and a control group. The study was registered in the Iranian Registry of Clinical Trials under the code of IRCT2016012723520N2. The research was conducted in Zanjan, Iran. The study population included all patients undergoing hemodialysis referred to Vali-Asr Hospital dialysis center. Vali-Asr Hospital, one of the educational hospitals affiliated to Zanjan University of Medical Sciences, is the only hemodialysis center in Zanjan. Permission for the research was granted by the Ethics Committee (ZUMS.REC.1393.214). The aim of the study was explained to all participants, and the confidentiality of the information was assured. Written consent to participate in the study was taken from the patients, and they were told they were free to withdraw from the study at any time.

An estimated 43 people in each group were needed in the study to give a confidence level of 95%, power of 80%, and effect size of 0.6 according to recent studies.[23] Among patients undergoing hemodialysis, a lottery without replacement was conducted to select participants from a list. These patients were randomly assigned to one of two groups by throwing a dice; even days (Sunday, Tuesday, and Thursday) to the experimental group and odd days (Saturday, Monday, and Wednesday) to the control group. If a patient among those selected by lottery had the inclusion criteria, she/he would be chosen as a sample. Samples for the two groups were selected by the hemodialysis ward head nurse who was not a member of the research team. The selected patients were not aware of which group they belonged. Moreover, another nurse (not aware of the study and research purposes) recorded patient's biochemical indicators and weight.

Patients aged (18–65) years, with a hemodialysis history of at least three consecutive months, having hemodialysis twice a week or more, with access to a fixed-line or mobile phone, with good hearing, and who gave their informed consent were included in the study. Patients reluctant to cooperate in every step of the study, those who stopped dialysis for any reason, and those who died were excluded.

Interviews with the patients and a review of their charts were used to collect the patient's demographic data. Laboratory and IWG parameters were used to measure treatment adherence. Biochemical indicators were blood urea nitrogen (BUN), sodium, potassium, calcium, and phosphorus levels, and IWG, which were measured before the start of dialysis, and albumin levels measured after the dialysis.

Patient's adherence to protein and phosphorus regimens was examined using the BUN index. Receiving adequate calories and energy through carbohydrate and fat intake and receiving alternative supplements for protein in the diet were examined by checking BUN and albumin levels. Patient's adherence to fluid and sodium consumption restrictions were assessed by examining IWG and the sodium index. Also, the patient's adherence to regular dialysis attendance, diet, and drugs was assessed by examining phosphorus, potassium, sodium, and calcium levels, and IWG.

BUN levels over 100.0 mg/dL indicated nonadherence to a low-protein diet. Potassium levels over 6.5 mEq/L indicated nonadherence to a low potassium diet whereas potassium levels 5.6–6.5 mEq/L showed average adherence and potassium levels 3.5–5.5 mEq/L indicated good adherence. A serum phosphate level over 6.5 mg/dL indicated nonadherence to a low phosphate diet and medication regimen, 4.6–6.5 mg/dL indicated average adherence, and 2.5–4.5 mg/dL indicated good adherence. A normal calcium range and adherence was considered between 8.5–10.5 mg/dL (lower was considered nonadherence). A normal sodium range and adherence was considered between 135.0–145.0 mg/dL (higher was considered nonadherence). A severe loss of albumin was a level less than 3.0 mg/dL, an average loss of albumin was 3.0–3.5 mg/dL, and a normal albumin level was more than 3.5 mg/dL and were considered as nonadherence, average adherence, and good adherence, respectively. If the weight difference between two consecutive sessions of hemodialysis was more than 3.0 kg, it showed that the patient did not adhere to restrictions on fluid intake. A weight difference between two hemodialysis sessions of 1.6–3.0 kg represented average adherence, and a weight difference in the range of 1.0–1.5 kg represented good adherence to fluid intake.[3] All laboratory tests were done at Vali-Asr Hospital Laboratory with the same equipment. It must be noted that the scales used for weighing patients in both groups were identical and their accuracy was evaluated before each use.

Biochemical indicators and IWG at baseline were measured in the fourth, eighth, and the twelfth week of the study in both experimental and control groups.

At baseline, in the experimental group, according to a preliminary collection of biochemical indicators and IWG, the problem of nonadherence to treatment became clear. Based on the patient's needs, two to three face-to-face counseling sessions for each patient were held in the hospital educational classroom. Through in-person meetings, problems related to treatment adherence were identified. Then, via these sessions and under the guidance of researchers, patients could choose the best solution for their nonadherence problem. In addition, based on the information given by the patient and biochemical indicators, which were measured monthly for each patient in the experimental group, a diet with multiple options was designed by a dietitian and given to the patients at the beginning of the intervention, and in the fourth and eighth week of the research.

After in-person consultations, follow-up consultations were conducted by phone. During phone conversations, patients' adherence to the treatment programs (adhering to dietary restrictions and fluid intake, the timely taking of medicines, and regular attendance for hemodialysis) were evaluated at regular intervals. Phone follow-up for the experimental group was 28 phone calls over 12 weeks (in the first four weeks three calls per week and in the remaining eight weeks two calls per week). On average, phone talk time was 10 to 15 minutes. In these conversations, patients were evaluated in all aspects of treatment adherence and treatment program, their questions were answered and, if there was a problem, appropriate and various solutions were suggested so that they could choose among them. Nurse researcher and dietitian's phone numbers were available to all patients, so they could call if necessary and ask about their problem.

In the control group, there was no special nurse in charge of educating patients and tracking their treatment adherence. Patients received their information from different nurses; thus, these pieces of information were not consistent and ongoing. Patients recently recommended for hemodialysis treatment received general education about hemodialysis (including diet, mobility rates, and fistula and shunt care) at the beginning of their introduction to the hemodialysis ward. During the hemodialysis period, according to the results of the patients' biochemical indicators, the patients were notified about following the diet, medication, and attendance at dialysis sessions by the doctor or nurses present in the ward, but the reasons for the patients' nonadherence were not negotiated. However, to observe ethical considerations in this research, a booklet was given to the patients in the control group. This booklet contained information about diet, fluid restrictions, and the importance of regular drug use and regular presence in dialysis sessions. If the patients in the control group had questions about the information of the booklet, the researcher would answer these questions.

For data analysis, descriptive statistics (frequency, mean, and standard deviation) was used. The Kolmogorov-Smirnov test was used to review the test data for normality. Chi-square test and Fisher's exact test were used to compare the biochemical indicators and IWG in the experimental and control groups. Friedman and Cochran's Q tests were employed to evaluate the changes within the experimental and control groups during the four time points of the variable under study.

## RESULTS

In this study, all 86 patients assessed were assigned to the two groups. Each group consisted of 43 patients, and all 86 patients completed the study. The mean age of the patients was 52.5±11.3 years, over half (55.8%) were male, and the majority (82.6%) did not have a high school diploma. Most (43.1%) were undergoing hemodialysis for one to two years. The demographic characteristics were not significantly different between the two groups [Table 1].

At baseline, comparing indices of sodium, phosphorus, calcium, BUN, and IWG using the chi-square test, and potassium and albumin with Fisher's exact test showed that the differences in these indices were not statistically significant [Tables 2 and 3] in either group.

In the fourth week of the study, comparing calcium index between the two groups using Fisher's exact test and IWG with the chi-square test showed significant differences. However, in the BUN index, there were no significant differences between the experimental and control groups when using the chi-square test, and sodium index, potassium, phosphorus, and albumin indices with Fisher's exact test [Tables 2 and 3].

In the eighth week of study, comparing calcium, phosphorus, potassium, and IWG indices between the two groups using Fisher's exact test and BUN index with chi-square test revealed significant differences between the two groups suggesting increased adherence in the experimental group.

**Table 1:** Comparison of the demographic variables of patients in the experimental and control groups

| Variables | E | | C | | χ2 |
|---|---|---|---|---|---|
| | n | % | n | % | |
| **Gender** | | | | | |
| Male | 24 | 55.8 | 24 | 55.8 | $p$ = 0.999<br>df = 1 |
| Female | 19 | 44.2 | 19 | 44.2 | χ2 = 0.000 |
| **Educational level** | | | | | |
| Illiterate | 21 | 48.8 | 21 | 48.8 | $p$ = 0.972* |
| Under diploma | 14 | 32.6 | 15 | 34.9 | df = 2 |
| Diploma | 5 | 11.6 | 5 | 11.6 | FET = 0.234 |
| Higher diploma | 3 | 7.0 | 2 | 4.7 | |
| **Economic status** | | | | | |
| Inadequate | 29 | 67.4 | 34 | 79.1 | $p$ = 0.244* |
| Fairly adequate | 9 | 20.9 | 8 | 18.6 | df = 2 |
| Adequate | 5 | 11.6 | 1 | 2.3 | FET = 0.345 |
| **Age, years** | | | | | |
| < 40 | 6 | 14.0 | 4 | 9.3 | $p$ = 0.672* |
| 40–50 | 9 | 20.9 | 7 | 16.3 | df = 3 |
| 51–59 | 12 | 27.9 | 17 | 39.5 | FET = 0.346 |
| ≥ 60 | 16 | 37.2 | 15 | 34.9 | |
| **History of dialysis** | | | | | |
| < 1 year | 9 | 20.9 | 13 | 30.2 | $p$ = 0.431 |
| 1–2 years | 18 | 41.9 | 19 | 44.2 | df = 2 |
| > 2 years | 16 | 37.2 | 11 | 25.6 | χ2 = 0.267 |
| **Diabetes mellitus** | | | | | |
| Yes | 18 | 41.9 | 14 | 32.6 | $p$ = 0.504<br>df = 1, |
| No | 25 | 58.1 | 29 | 67.4 | χ2 = 0.796 |
| **Hypertension** | | | | | |
| Yes | 35 | 81.4 | 33 | 76.7 | $p$ = 0.396<br>df = 1 |
| No | 8 | 18.6 | 10 | 23.3 | χ2 = 0.281 |
| **Hyperlipidemia** | | | | | |
| Yes | 11 | 25.6 | 8 | 18.6 | $p$ = 0.0302<br>df = 1 |
| No | 32 | 74.4 | 35 | 81.4 | χ2 = 0.608 |
| **Smoking** | | | | | |
| Yes | 4 | 9.3 | 10 | 23.3 | $p$ = 0.071<br>df = 1 |
| No | 39 | 90.7 | 33 | 76.7 | χ2 = 3.071 |
| **History of heart disease** | | | | | |
| Yes | 1 | 2.3 | 1 | 2.3 | $p$ = 1.000* |
| No | 42 | 97.7 | 42 | 97.7 | df = 1<br>FET = 0.000 |
| **History of liver disease** | | | | | |
| Yes | 1 | 2.3 | 0 | 0.0 | $p$ = 1.000*<br>df = 1 |
| No | 42 | 97.7 | 43 | 100 | FET = 0.012 |

*E: experimental; C: control; χ2: chi-square; FET: Fisher's exact test.*
**Fisher's exact test. p-value < 0.050 significant.*

**Table 2:** Comparison between and within group of potassium, phosphorus, albumin and weight gain for participants in the experimental (E) and control (C) groups through before, four, eight, and 12 weeks after intervention.

| Variables | Before | | | | | | 4 weeks | | | | | | 8 weeks | | | | | | 12 weeks | | | | | | FT W-G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GA | | AA | | NA | | GA | | AA | | NA | | GA | | AA | | NA | | GA | | AA | | NA | | |
| | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | |
| **Potassium** | | | | | | | | | | | | | | | | | | | | | | | | | |
| E | 22 | 51.2 | 15 | 34.9 | 6 | 14.0 | 30 | 69.8 | 12 | 27.9 | 1 | 2.3 | 35 | 81.4 | 8 | 18.6 | 0 | 0.0 | 37 | 86.0 | 6 | 14.0 | 0 | 0.0 | $p < 0.001$ df = 3, FT=34.932 |
| C | 22 | 51.2 | 19 | 44.2 | 2 | 4.7 | 23 | 53.5 | 18 | 41.9 | 2 | 4.7 | 19 | 44.2 | 20 | 46.5 | 4 | 9.3 | 21 | 48.8 | 16 | 37.2 | 6 | 14.0 | $p = 0.065$ df = 3, FT = 7.216 |
| FET B-G | $p = 0.301$, df = 2, FE-T = 2.471 | | | | | | $p = 0.306$, df = 2, FE-T = 2.458 | | | | | | $p < 0.001$, df = 2, FE-T = 13.844 | | | | | | $p < 0.001$, df = 2, FE-T = 14.959 | | | | | | |
| **Phosphorus** | | | | | | | | | | | | | | | | | | | | | | | | | |
| E | 12 | 27.9 | 17 | 39.5 | 14 | 32.6 | 22 | 51.2 | 17 | 39.5 | 4 | 9.3 | 32 | 74.4 | 8 | 18.6 | 3 | 7.0 | 37 | 86.0 | 6 | 14 | 0 | 0.0 | $p < 0.001$ df = 3, FT = 60.978 |
| C | 16 | 37.2 | 17 | 39.5 | 10 | 23.3 | 15 | 34.9 | 20 | 46.5 | 8 | 18.6 | 12 | 27.9 | 23 | 53.5 | 8 | 18.6 | 13 | 30.2 | 24 | 55.8 | 6 | 14.0 | $p = 0.820$ df = 3, FT = 922 |
| FET B-G | $p = 0.538$*, df = 2, $\chi2 = 1.238$ | | | | | | $p = 0.234$, df = 2, FE-T = 2.901 | | | | | | $p < 0.001$, df = 2, FE-T = 18.622 | | | | | | $p < 0.001$, df = 2, FE-T = 28.320 | | | | | | |
| **Weight gain** | | | | | | | | | | | | | | | | | | | | | | | | | |
| E | 12 | 27.9 | 20 | 46.5 | 11 | 25.6 | 16 | 37.2 | 18 | 41.9 | 9 | 20.9 | 24 | 55.8 | 16 | 37.2 | 3 | 7.0 | 26 | 26 | 60.5 | 37.2 | 1 | 2.3 | $p < 0.001$ df = 3, FT = 52.773 |
| C | 10 | 23.3 | 20 | 46.5 | 13 | 30.2 | 8 | 18.6 | 23 | 53.5 | 12 | 27.9 | 9 | 20.9 | 20 | 46.5 | 14 | 32.6 | 8 | 8 | 18.7 | 51.1 | 13 | 30.2 | $p = 0.532$ df = 3, FT = 2.200 |
| FET B-G | $p = 0.834$*, df = 2, $\chi2 = 0.362$ | | | | | | $p < 0.001$*, df = 2, $\chi2 = 3.484$ | | | | | | $p < 0.001$, df = 2, FE-T = 14.183 | | | | | | $p < 0.001$, df = 2, FE-T = 20.482 | | | | | | |
| **Albumin** | | | | | | | | | | | | | | | | | | | | | | | | | |
| E | 36 | 83.7 | 5 | 11.6 | 2 | 4.7 | 38 | 88.4 | 4 | 9.3 | 1 | 2.3 | 39 | 90.7 | 3 | 7.0 | 1 | 2.3 | 41 | 95.3 | 2 | 4.7 | 0 | 0.0 | $p = 0.031$ df = 3, FT = 8.902 |
| C | 37 | 86.0 | 3 | 7 | 3 | 7.0 | 33 | 76.7 | 6 | 14.0 | 4 | 9.3 | 32 | 74.4 | 6 | 14.0 | 5 | 11.6 | 33 | 76.6 | 8 | 18.6 | 2 | 4.7 | $p = 0.539$ df = 3, FT = 2.165 |
| FET B-G | $p = 0.816$, df = 2 $\chi2 = 0.714$ | | | | | | $p = 0.267$, df = 2, $\chi2 = 2.552$ | | | | | | $p = 0.101$, df = 2, FE-T = 4.357 | | | | | | $p = 0.03$, df = 2, FE-T = 6.465 | | | | | | |

*GA: good adherence; AA: average adherence; NA: nonadherence; B-G: between-group; W-G: within-group; FET: Fisher's exact test; χr2: chi-square; FT: Friedman test; p < 0.050.*

**Table 3:** Comparison between and within study groups of calcium, sodium, and blood urea nitrogen (BUN) levels for participants in the experimental (E) and control (C) groups the intervention and four, eight, and 12 weeks after.

| Variables | Before | | | | 4 weeks | | | | 8 weeks | | | | 12 weeks | | | | Cochran's Q test (CQ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | | NA | | A | | NA | | A | | NA | | A | | NA | | |
| | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | |
| **Calcium** | | | | | | | | | | | | | | | | | |
| E | 31 | 72.1 | 12 | 27.9 | 39 | 0.7 | 4 | 9.3 | 42 | 97.7 | 1 | 2.3 | 42 | 97.7 | 1 | 2.3 | $p = 0.001$ df = 3, CQ = 22.091 |
| C | 27 | 62.8 | 16 | 37.2 | 29 | 67.4 | 14 | 32.6 | 32 | 74.4 | 11 | 25.6 | 33 | 76.7 | 10 | 23.3 | $p = 0.228$ df = 3, CQ = 4.333 |
| FET B-G | $p = 0.357^*$, df = 1, $\chi2 = 0.847$ | | | | $p = 0.008$, df = 1, $\chi2 = 7.026$ | | | | $p < 0.001$, df = 1, $\chi2 = 9.685$ | | | | $p < 0.001$, df = 1, $\chi2 = 8.444$ | | | | $p = 0.357^*$, df = 1, $\chi2 = 0.847$ |
| **Sodium** | | | | | | | | | | | | | | | | | |
| E | 39 | 90.7 | 4 | 9.3 | 39 | 90.7 | 4 | 9.3 | 42 | 97.7 | 1 | 2.3 | 42 | 97.7 | 1 | 2.3 | $p = 0.080$ df = 3, CQ = 6.750 |
| C | 40 | 93.0 | 3 | 7.0 | 40 | 93.0 | 3 | 7.0 | 39 | 90.7 | 4 | 9.3 | 41 | 95.3 | 4 | 9.3 | $p = 0.836$ df = 3, CQ = 0.857 |
| FET B-G | $p = 0.693^*$, df = 1, $\chi2 = 0.156$ | | | | $p = 1.000$, df = 1, $\chi2 = 0.156$ | | | | $p = 0.360$, df = 1, $\chi2 = 1.911$ | | | | $p = 1.000$, df = 1, $\chi2 = 0.345$ | | | | $p = 0.693^*$, df = 1, $\chi2 = 0.156$ |
| **BUN** | | | | | | | | | | | | | | | | | |
| E | 36 | 83.7 | 7 | 16.3 | 41 | 95.3 | 2 | 4.7 | 42 | 97.7 | 1 | 2.3 | 42 | 97.7 | 1 | 2.3 | $p = 0.001$ df = 3, CQ = 15.632 |
| C | 39 | 90.7 | 4 | 9.3 | 36 | 83.7 | 7 | 16.3 | 35 | 81.4 | 8 | 18.6 | 37 | 86.0 | 6 | 14.0 | $p = 0.241$ df = 3, CQ = 4.200 |
| FET B-G | $p = 0.333^*$, df = 1, $\chi2 = 0.938$ | | | | $p = 0.158^*$, df = 1, $\chi2 = 3.102$ | | | | $p = 0.030^*$, df = 1, $\chi2 = 6.081$ | | | | $p = 0.030^*$, df = 1, $\chi2 = 6.081$ | | | | |

*A: adherence; NA: nonadherence; B-G: between-group; FET: Fisher's exact test; *χ2: chi-square; p-value < 0.050 significant.*

**Table 4:** The effect of intervention on biochemical indicators using generalized estimating equations.

| Variables | B | 95% Wald confidence interval | | df | *p*-value |
|---|---|---|---|---|---|
| | | Lower | Upper | | |
| Potassium | -0.939 | -1.680 | -0.198 | 1 | 0.013 |
| Phosphorus | -0.997 | -1.683 | -0.312 | 1 | 0.004 |
| Weight gain | -1.069 | -1.839 | -0.298 | 1 | 0.007 |
| Albumin | -1.083 | -2.071 | -0.094 | 1 | 0.032 |
| Calcium | -1.224 | -1.976 | -0.473 | 1 | 0.001 |
| Sodium | -6.419E-16 | -1.364 | 1.364 | 1 | 1.000 |
| BUN | -0.954 | -2.077 | 0.169 | 1 | 0.096 |

*BUN: blood urea nitrogen; p-value < 0.050 significant.*

Comparing sodium and albumin indices using Fisher's exact test showed no statistically significant differences between the experimental and control groups [Tables 2 and 3].

In the twelfth week of study, comparing potassium, phosphorus, calcium, albumin, and IWG indices between the two groups using Fisher's exact test indicated statistically significant differences. However, comparing sodium and BUN indices using Fisher's exact test demonstrated no statistically significant difference between the groups [Tables 2 and 3].

Intra-group comparison of indices changes in potassium, phosphorus, albumin, and IWG at the four time-points of the study (baseline, fourth, eighth, and twelfth weeks) in the experimental group using the Friedman test found statistically significant differences, suggesting an increased adherence. In the control group, intra-group changes were not statistically significant [Tables 2 and 3].

To investigate the effect of the intervention on biochemical indicators at the four time points of the study, we used generalized estimating equations (GEE). GEE results showed that the effect of the intervention on potassium, phosphorus, IWG, albumin, and calcium indices were statistically significant. The intervention had no significant statistical effect on sodium, blood urea, and nitrogen indices [Table 4].

## DISCUSSION

Counseling and phone follow-up led to the improvement of calcium index and IWG in the experimental group in the fourth week. In the eighth week of the study, calcium, phosphorus, potassium, BUN, and IWG indices in the experimental group had a favorable condition compared to the control group. By the twelfth week, in the experimental group, calcium, phosphorus, potassium, albumin, and IWG were still within the recommended treatment adherence range and showed a statistically significant difference when compared to the control group. Intervention in the experimental group resulted in an improvement of most biochemical indicators and IWG over the 12-week study. Reviewing the biochemical indicators in the eighth and twelfth weeks after the intervention showed that most patients in the experimental group (when compared with the control group) were at good adherence level in terms of potassium index. Our result is inconsistent with the results of two other studies, which reported that patients' potassium index in the experimental group was in the normal range following educational interventions.[23,24] In both studies, educational and nutritional sessions were held to increase adherence. Face-to-face teaching methods and video playback were used to enhance the effectiveness of these studies. In the current study, having the choice of the recommended nutritional items and mutual interaction between researchers and patients led to the active participation of patients in their health care and consequently increased adherence.

Low treatment adherence often results in increased serum potassium and phosphorus levels.[9] Analyzing the data regarding phosphorus index showed that phosphorus levels of patients in the experimental group was significantly reduced. No patients in the experimental group in the twelfth week after the intervention had nonadherence regarding phosphorus index, which was associated with following the low-phosphorus diet and medication regimen. This result concurs with the results of two other studies, which concluded that implementing educational intervention and self-care education led to diet compliance.[25,26] Moreover, a decrease in phosphorus level demonstrates that nurses conducting educational interventions can play an important role in controlling phosphorus levels and complications related to its inappropriate control.[25,26] Nursing consultation and a patient's active role and engagement in clinical decisions leads to an increase in the patient's awareness and understanding level, leading to improved treatment adherence.[16]

In our study, patients' reduction in IWG in the experimental group was statistically significant compared with the control group. Another study concluded that educational intervention reduced IWG in hemodialysis patients.[19] However, there was no follow-up in the study.[19] A similar study concluded that better control of IWG is achieved if educational services are accompanied with follow-up in hemodialysis patients.[27] In our study, frequent follow-up phone calls were affecting factors in reducing IWG for patients in the experimental group, which caused the patients to attend dialysis sessions regularly.

There was no statistically significant difference in blood albumin between the two groups at the beginning of the intervention and four and eight weeks after. Nevertheless, this difference was significant in the twelfth week after the intervention and a greater percentage of patients in the experimental group were within the normal albumin range. Two studies found no significant differences in the mean albumin range before and after the educational intervention.[23,26] One of the reasons for the positive effect of the intervention we observed on albumin range might be due to the follow-up phone calls, which increased treatment adherence. Similarly, another study found a significant difference in mean albumin levels before and after the educational intervention. The authors of this study also used the continual care model, which showed the positive effect of follow-up on improving adherence in hemodialysis patients.[28] In our study, in addition to frequent follow-up, we included carbohydrates and fats as sources of energy in the diet to improve albumin levels. The calcium level of the participants was also modified and reached normal levels as a result of modifying the albumin levels (due to nutritional counseling). Regular attendance, attending all dialysis sessions, and full implementation of the pharmacological recommendations by patients were other factors leading to the changes in blood calcium in the intervention group.

There was no statistically significant difference in the blood sodium levels of the two groups at baseline, and the fourth, eighth, and twelfth weeks of the study. This result is consistent with other studies, which found no significant difference in the sodium range after the intervention.[26,27] This lack of difference was because, at baseline, sodium levels in more than 90% of patients in both groups were within the normal range. Although the level of BUN was decreased at four, eight, and 12 weeks after the intervention, only BUN levels at week eight were statistically significant. Although the two indices of sodium and BUN were not statistically significant between the two groups, providing the patients with a monthly diet together with continuous counseling was able to reduce other biochemical indicators and IWG.

Intra-group comparison of biochemical indicators and IWG changes from baseline to 12-weeks post-intervention showed that the experimental group experienced an increase in adherence. However, in the control group by the twelfth week, no statistically significant change was observed in treatment adherence. This result suggests that counseling and frequent phone follow-up in the studied group increased adherence and, in turn, improved biochemical indicators and IWG in the experimental group.

Considering that 82.6% of participants in this study had a low level of education, the study intervention was effective due to the continuous relationship between the researcher and the patients in increasing adherence. Asking patients to participate in identifying any misunderstandings and misconceptions about treatment adherence improved their compliance.

One of the major limitations of this study was the irregular attendance of some patients due to economic reasons, which overshadowed patient treatment adherence. Random allocation was performed to modify the confounding effect of the patients' economic problems in this research. The other limitation of this study was the low sample size, which limits the generalizability of this study.

Hence, a similar study design with high sample size is recommended.

## CONCLUSION

Consultation and follow-up phone calls in hemodialysis patients are suggested because they improve patient adherence and, as a result, their biochemical indicators. We recommend that nurses in hemodialysis centers are in charge of conducting patient follow-up by phone so that they can monitor patients' diet and treatment adherence. Also, we recommend applying this intervention in low-literacy hemodialysis patients to control biochemical indicators and IWG.

***Disclosure***

The authors declared no conflict of interests. This study was supported by a research grant from Zanjan University of Medical Sciences.

***Acknowledgements***

The current research forms a part of the MSc thesis of the second author. The researchers of this study express their sincere thanks to the Vice-chancellery for Research of Zanjan University of Medical Sciences due to his financial support for this project, to all staff in hemodialysis ward of Vali-Asr Hospital in Zanjan city and to honorable hemodialysis patients.

### REFERENCES

1. Mohseni R, Emami Zeydi A, Ilali E, Adib-Hajbaghery M, Makhlough A. The effect of intradialytic aerobic exercise on dialysis efficacy in hemodialysis patients: a randomized controlled trial. Oman Med J 2013 Sep;28(5):345-349.
2. Wells C. Optimizing nutrition in patients with chronic kidney disease. Nephrol Nurs J 2003 Dec;30(6):637-646, quiz 647-648.
3. Denhaerynck K, Manhaeve D, Dobbels F, Garzoni D, Nolte C, De Geest S. Prevalence and consequences of nonadherence to hemodialysis regimens. Am J Crit Care 2007 May;16(3):222-235, quiz 236.
4. Grassmann A, Gioberge S, Moeller S, Brown G. ESRD patients in 2004: global overview of patient numbers, treatment modalities and associated trends. Nephrol Dial Transplant 2005 Dec;20(12):2587-2593.
5. Palmer SC, Hanson CS, Craig JC, Strippoli GF, Ruospo M, Campbell K, et al. Dietary and fluid restrictions in CKD: a thematic synthesis of patient views from qualitative studies. Am J Kidney Dis 2015 Apr;65(4):559-573.
6. Li H, Jiang YF, Lin C-C. Factors associated with self-management by people undergoing hemodialysis: a descriptive study. Int J Nurs Stud 2014 Feb;51(2):208-216.
7. Stirratt MJ, Dunbar-Jacob J, Crane HM, Simoni JM, Czajkowski S, Hilliard ME, et al. Self-report measures of medication adherence behavior: recommendations on optimal use. Transl Behav Med 2015 Dec;5(4):470-482.
8. Nguyen TM, La Caze A, Cottrell N. What are validated self-report adherence scales really measuring?: a systematic review. Br J Clin Pharmacol 2014 Mar;77(3):427-445.
9. Clark S, Farrington K, Chilcot J. Nonadherence in dialysis patients: prevalence, measurement, outcome, and psychological determinants. Semin Dial 2014 Jan-Feb;27(1):42-49.
10. Kugler C, Maeding I, Russell CL. Non-adherence in patients on chronic hemodialysis: an international comparison study. J Nephrol 2011 May-Jun;24(3):366-375.
11. Chow SK, Wong FK. Health-related quality of life in patients undergoing peritoneal dialysis: effects of a nurse-led case management programme. J Adv Nurs 2010 Aug;66(8):1780-1792.
12. Zolfaghari M, Mousavifar SA, Pedram S, Haghani H. The impact of nurse short message services and telephone follow-ups on diabetic adherence: which one is more effective? J Clin Nurs 2012 Jul;21(13-14):1922-1931.
13. Tsai W-C, Yang J-Y, Luan C-C, Wang Y-J, Lai Y-C, Liu L-C, et al. Additional benefit of dietitian involvement in dialysis staffs-led diet education on uncontrolled hyperphosphatemia in hemodialysis patients. Clin Exp Nephrol 2016 Oct;20(5):815-821.
14. Vann JC, Hawley J, Wegner S, Falk RJ, Harward DH, Kshirsagar AV. Nursing intervention aimed at improving self-management for persons with chronic kidney disease in North Carolina medicaid: A pilot project. Nephrol Nurs J 2015 May-Jun;42(3):239-255, quiz 256.
15. Karavetian M, de Vries N, Elzein H, Rizk R, Bechwaty F. Effect of behavioral stage-based nutrition education on management of osteodystrophy among hemodialysis patients, Lebanon. Patient Educ Couns 2015 Sep;98(9):1116-1122.
16. Alikari V, Matziou V, Tsironi M, Theofilou P, Zyga S. The effect of nursing counseling on improving knowledge, adherence to treatment and quality of life of patients undergoing hemodialysis. International Journal of Caring Sciences 2015;8(2):514-518.
17. Laitakari J, Miilunpalo S, Vuori I. The process and methods of health counseling by primary health care personnel in Finland: a national survey. Patient Educ Couns 1997 Jan;30(1):61-70.
18. Zeighami R, Alipour Heidari M. The effect of continuous care model on quality of life of patients after coronary angioplasty in Bou Ali Sina hospital. Evidence Based Care. 2014 Apr;4(1):61-70.
19. Deif HI, Elsawi K, Selim M. NasrAllah MM. Effect of an educational program on adherence to therapeutic regimen among chronic kidney disease stage5 (CKD5) patients under maintenance hemodialysis. J Educ Pract 2015;6(5):21-33.
20. Martín-Lesende I, Orruño E, Bilbao A, Vergara I, Cairo MC, Bayón JC, et al. Impact of telemonitoring home care patients with heart failure or chronic lung disease from primary care on healthcare resource use (the TELBIL study randomised controlled trial). BMC Health Serv Res 2013 Mar;13:118.
21. Hashemi S, Tayebi A, Rahimi A, Einolahi B. Examining the effect of continuous care model on adherence to dietary regimen among patients receiving hemodialysis. Iran J Crit Care Nurs 2015;7(4):215-220.
22. Connor A, Mortimer F, Higgins R. The follow-up of renal transplant recipients by telephone consultation: three years experience from a single UK renal unit. Clin Med (Lond) 2011 Jun;11(3):242-246.
23. Beraz S, Mohammadi E, Bromand B. Effects of diet on laboratory parameters and weight gain between the two sessions dialysis in patients undergoing maintenance hemodialysis. Shahrekord University of Medical Sciences 2006;8(1):20-27.
24. Abbasi M, Mirzaei S, Mousavi Movahed M, Sho'ouri A, Norouz Zadeh R. The effects of education methods on body weight and some of serum indices in hemodialysis patients referred to Qom Kamkar Hospital. Qom Univ Med Sci J 2007;1(3):45-51.
25. Durose CL, Holdsworth M, Watson V, Przygrodzka F. Knowledge of dietary restrictions and the medical consequences of noncompliance by patients on hemodialysis are not predictive of dietary compliance. J Am Diet Assoc 2004 Jan;104(1):35-41.

26. Ebrahimi H, Sadeghi M. The effect of dietary regimen education on the laboratory variables in hemodialysis patients. 3 JNE 2014;2(4):12-22.
27. Mondaloo S, Dehghankar L, Zolfaghari M, Ghiyasvand AM, Heydarabadi AB, Kashfi SH. The effects of training and follow-up via text messaging on weight control in hemodialysis patients. J Appl Environ Biol Sci 2015;5(6)-287-292.
28. Rahimi A, Ahmadi F, Gholyaf M. Effects of applying continuous care model on blood tests in hemodialysis patients. TUMJ 2008;66(1):43-51.