DOI: https://doi.org/10.31351/vol31iss1pp95-101

Adherence to Different Treatment Modalities among Patients on Maintenance Hemodialysis

Maha A. Abdul-Jabbar*[1] and Dheyaa J. Kadhim**

[*] Al Nuaman general Hospital, Ministry of Health and Environment, Baghdad, Iraq.
[**]Department of Clinical Pharmacy, College of Pharmacy, University of Baghdad, Baghdad, Iraq.

Abstract

End Stage Renal Disease is a well-known global public health problem. Maintenance hemodialysis is considered a life-saving treatment for patients with such disease. This treatment method that requires patients to be adherent to hemodialysis attendance, dietary and fluid recommendations as well as adherence to prescribed medications to ensure success. The aim of the current study was to assess adherence, perception, and counseling among hemodialysis patients to different modalities of treatment (fluid restriction, dietary recommendations, medications, and hemodialysis schedules). A cross-sectional study carried out on hemodialysis patients who attended to the dialysis centers at al- Karama teaching hospital and Madinat Al- Imamain Al- Kadhimain teaching hospital. The Arabic version of the " end stage renal disease-adherence questionnaire " was used in assessing adherence, perception, and counseling. The number of recruited patients was 200 adult patients (113 men and 87 women). The average of the total adherence score lies within the moderate adherence (984.9 ±174.2). Patients adherence to the hemodialysis session was good as representing by high scores of adherence for (hemodialysis-attendance, episode of hemodialysis-shortening and duration of hemodialysis-shortening) while the lowest adherence score (126.0 out of 200) was for following the fluid restriction. In terms of adherence categories, the majority (61%) of the patients had good adherence, 33.0% had moderate adherence with 6% had poor adherence. Age had a significant positive association with the total adherence score. All patients perceived their hemodialysis management as highly/very important. On the other hand, some patients perceived their adherence to the recommended diet as moderately (7%) or less important (7%). Regarding the frequency of counseling received by patients for different treatment modalities. The negative answers represented 58.5% of answers about the how important is to follow a proper diet, and 25.0% of answers about the importance of taking prescribed medications as ordered. Accordingly, the overall adherence of hemodialysis patients to different treatment modalities was less than optimum with fluid and diet adherence representing most challenging tasks in the health care of hemodialysis patients.

Keywords: Adherence, Hemodialysis, Chronic kidney disease, ESRD-adherence questionnaire, Iraq

الالتزام بطرق العلاج المختلفة لدى المرضى المستمرين على غسيل الكلى الدموي

مها عامرعبد الجبار *[،1] و ضياء جبار كاظم**

[*] مستشفى النعمان العام، وزارة الصحة والبيئة، بغداد، العراق.
[**] فرع الصيدلة السريرية، كلية الصيدلة، جامعة بغداد، بغداد، العراق.

الخلاصة

يعد مرض الكلى في المرحلة النهائية من المشكلات الصحية العامة المتزايدة المعروفة على مستوى العالم. غسيل الكلى المزمن هو إجراء لإنقاذ حياة المرضى الذين يعانون من مرض الكلى في المرحلة النهائية. تتطلب طريقة العلاج هذه الالتزام بالأدوية الموصوفة وعلاج غسيل الكلى والتقييدات المتعلقة بالأغذية والسوائل لضمان نجاحها. كان الهدف من الدراسة الحالية هو تقييم الالتزام ، والإدراك ، وتقديم المشورة بين مرضى غسيل الكلى لطرق العلاج المختلفة (تقييد السوائل ، والتوصيات الغذائية ، والأدوية ، وجداول غسيل الكلى). أجريت هذه الدراسة المقطعية على مرضى غسيل الكلى الذين حضروا إلى مراكز غسيل الكلى في مستشفى الكرامة التعليمي ومستشفى مدينة الإمامين الكاظمين التعليمي. تم استخدام النسخة العربية من استبيان الالتزام بمرض الكلى في المرحلة النهائية لتقييم الالتزام ، والإدراك ، والاستشارة. بلغ عدد المرضى المشمولين بالدراسة ٢٠٠ مريض بالغ (١١٣ رجلاً و ٨٧ امرأة). يقع متوسط مجموع نقاط الالتزام ضمن معدل الالتزام المعتدل (٩٨٤,٩ ± ١٧٤,٢). كان التزام المرضى بجلسة غسيل الكلى جيدًا لأنه يمثل درجات عالية من الالتزام لـــ (الحضور ، حالات تقصير ومدة تقصير غسيل الكلى) بينما كانت أقل درجة التزام (١٢٦,٠ من ٢٠٠) للالتزام بتقييد السوائل. من حيث فئات الالتزام ، كان لدى الغالبية (٦١٪) من المرضى التزام جيد ، و ٣٣,٠٪ لديهم التزام معتدل و ٦٪ لديهم التزام ضعيف. كان للعمر ارتباط إيجابي كبير مع مجموع نقاط الالتزام. اعتبر جميع المرضى أن جلسات غسيل الكلى الخاصة بهم مهمة للغاية / شديدة الأهمية. من ناحية أخرى ، اعتبر بعض المرضى أن التزامهم بالنظام الغذائي الموصى به معتدل الاهمية (٧٪) أو قليل الاهمية (٧٪). فيما يتعلق بتكرار الاستشارة التي يتلقاها المرضى للطرق العلاجية المختلفة. مثلت الإجابات السلبية ٥٨,٥٪ من الإجابات حول أهمية اتباع نظام غذائي سليم ، و ٢٥,٠٪ من الإجابات حول أهمية تناول الأدوية كما وصفت. وفقًا لذلك ، كان الالتزام العام لمرضى غسيل الكلى بطرائق العلاج المختلفة دون الوضع الأمثل ويمثل الالتزام بالسوائل والنظام الغذائي المهام الأكثر صعوبة في الرعاية الصحية لمرضى غسيل الكلى.

لكلمات المفتاحية: الالتزام ، غسيل الكلى الدموي، أمراض الكلى المزمنة، استبيان الالتزام بأمراض الكلى في المرحلة النهائية، العراق

---

[1]Corresponding author E-mail: maha.2020.clinical@gmail.com
Received: 21/5/2021
Accepted: 22/8 /2021

Introduction

Chronic kidney disease (CKD) is a progressively decrease in renal function, which may ultimately lead to renal failure requiring transplant or dialysis for survival [1]. Worldwide, in 2017, about 1.2 million people died due to CKD. The worldwide all-age rate of mortality from CKD increased by about 41.0% between 1990 and 2017. In 2017, about 697 million cases of all-stage CKD were reported, for a worldwide prevalence of 9.1%. The worldwide all-age prevalence of CKD increased by about 29.0% since 1990, however; the age-standardized prevalence remained stable [2]. A patient registry system is not available in most of developing countries. As a result, the accurate number CKD and end-stage renal disease (ESRD) patients are difficult to be obtained. The recorded prevalence of ESRD in Middle East area varies, between 818 per million populations (pmp) in Lebanon and 52 pmp in Iraq. The mean prevalence of ESRD in the whole Middle East is 430 pmp [3].

Adherence is defined as " the extent to which a person's behavior corresponds with the agreed recommendations of a healthcare provider in terms of taking medications, following a recommended diet and/or executing lifestyle changes" [4]. Generally, the World Health Organization (WHO) reported that long-term adherence to therapy among patients having chronic diseases in developed countries was about 50% and that the consequences of such non-adherence are poorer health-outcome and increased in the overall healthcare costs [5]. With respect to CKD patients, adherence to therapy is essential to prevent unnecessary progression and serious complications of this disease [6].

For patients with ESRD, chronic hemodialysis (HD) is a life-saving treatment [7], however; HD replaces about 10% of the normal kidney function. The average HD patient takes about 6–10 drugs a day in combination with many dietary restrictions. These complex therapeutic regimens place a significant burden on the patients and usually make them dependent on health-care providers for many aspects of their treatment [8]. The successful HD treatment depends highly on long-term adherence to different aspects of therapy such as regular dialysis attendance, fluid restriction, as well as adherence to medications and dietary advices. Despite that, adherence to such recommendations which involve lifestyle changes are frequently associated with significant difficulties for HD patients and the non-adherence rate to medications and lifestyle changes is highly recognized as a big problem in dialysis. The recorded prevalence of non-adherence among HD patients varies widely, ranging from 22%-74% [9, 10]. Non-adherence to HD results in many metabolic and cardiovascular disorders. Additionally, the risk of hospitalization was found to be increased due to non-adherence to diet, fluid, and medications treatment [4]. As a result, non-adherence is associated with increased mortality and healthcare-resource utilization and decreased in quality of life (QOL) of patients undergoing HD [9]. In contrast, enhanced treatment adherence has been linked with better outcomes [11].

In Iraq, patients with ESRD are mostly treated by chronic HD in governmental hospitals. Assessment of adherence rate for HD patients will give the healthcare providers the opportunity to implement interventional actions to minimize economic and health consequences related to non-adherence. The aim of the current study was to assess adherence, perception, and counseling among HD patients regarding different treatment modalities (fluid restriction, dietary recommendations, medications, and HD schedules).

Patients and Methods

Patients

The current study was a cross-sectional study carried out on already diagnosed ESRD patients on HD, who attended to the dialysis centers at al- Karama Teaching Hospital and Madinat Al-Imamain Al- Kadhimain Teaching Hospital, from November 2020 to January 2021.

Inclusion criteria

The inclusion criteria of the study were:

1-Patients with ESRD who were aged 18 years and above of both genders and willing to participate in the study.

2-Patients should be on regular HD for at least 6 months.

Exclusion criteria

Patients who provide incomplete information were excluded from the current study.

Data Collection

Demographic characteristics were collected by using a data sheet that includes age, gender, social status, educational level, residency, occupation, body mass index (kg/m^2), monthly income, smoking and alcoholic status, medications used, and the number and type of comorbidities.

In addition, the Arabic version of the ESRD-adherence questionnaire (ESRD-AQ) had been used to assess adherence. The questionnaire items distributed into five sections: the first section contained general and disease related information while the remaining four sections measures adherence to HD sessions, adherence to dietary recommendations, adherence to medications, and adherence to fluid restriction. These questions were scored and response of patients to these questions was summed to calculate the adherence behavior subscale. According to ESRD-AQ, higher scores means higher adherence to the measured behavior. The ESRD-AQ total score was categorized into

three levels: Poor (< 700), moderate (700-999) or good adherence (1000-1200) [12].

Ethical approval

The research proposal which explains the objectives behind the current study and the intended methods for collecting data was administered to the College of Pharmacy, University of Baghdad and the approval was obtained from scientific and ethical committee. In addition, approval was obtained from the Iraqi Ministry of Health. While approval from the patients to participate in the study was obtained verbally.

Administration of the questionnaires

When the patients arrived to the dialysis Center for HD sessions, they were interviewed and asked if they agree to participate in the current study, if they agreed, then a clarification of the questionnaire's questions were given while the patients were filling the research questionnaire till it had been filled completely.

Statistical analysis

Descriptive statistics (means, standard deviation, frequencies and percentages) were conducted for all study items. Data was analyzed using Statistical Package for the Social Sciences (SPSS) software version 25. Non-parametric tests were used due to not normal distribution of the included variables. The multiple regression analysis was conducted to measure the relationships between the independent variables (personal characteristics and duration of analysis) and the outcome variable (total adherence score). P-value of less than 0.05 was considered statistically significant.

Results

The number of recruited patients was 200 adult HD patients (113 men and 87 women). The average age of the patients was 50.4 ±15.0 years. Most (85.5%) of the participants had secondary school or lower education. More than two-thirds were unemployed and had low-income (<0.5 million Iraqi Dinars monthly). More than three-quarters (79.0%) lived in urban areas (Table 1).

The average of the total score lies within the moderate adherence (984.9 ±174.2). The findings show that patients adherence to the hemodialysis session was good as representing by high scores of adherence for the first three items (HD–attendance, episode of HD-shortening and duration of HD-shortening if shortened). In contrast, the lowest reported adherence score (126.0 out of 200) was for following the fluid restriction recommendations (Table 2**).** In terms of adherence categories, the majority (61%) of the patients had good adherence to their management regimens. However, 33.0 had moderate adherence and 6% had poor adherence (Table 3).

Table 1. Socio-demographic and clinical characteristics of patients

		Mean ± SD or number of patients (%)
Age (mean ± SD)		50.41± 15.01
Gender	Male	113 (56.5)
	Female	87 (43.5)
Social status	Single	32 (16.0)
	Married	133 (66.5)
	Divorced	10 (5.0)
	Widowed	25 (12.5)
Education level	Illiterate	28 (14.0)
	Primary school	70 (35.0)
	Secondary school	73 (36.5)
	University	29 (14.5)
Living place	Urban	158 (79.0)
	Rural	42 (21.0)
Profession	Employed	57 (28.5)
	Unemployed	143 (71.5)
Income (million Iraqi Dinars)	<0.5	133 (66.5)
	0.5-1.0	50 (25.0)
	>1.0	17 (8.5)
Duration of dialysis (mean ± SD) years		3.42 ± 2.58
Total medications (mean ± SD)		8.09 ± 2.69
Total comorbidities (mean ± SD)		1.88 ± 1.08

Table 2. Mean (± SD) of adherence score for various treatment modalities.

Adherence item	Range of score	Mean (SD)
HD– attendance " During the last month, how many dialysis treatments did you miss completely? "	0-300	260.00 (79.89)
Episode of shortening HD " During the last month, how many times have you shortened your dialysis time? "	0-200	185.00 (44.27)
Duration of shortening HD if shortened "During the last month, when your dialysis treatment was shortened, what was the average number of minutes ? "	0-100	90.13 (26.51)
Adherence to medication " During the past week, how often have you missed your prescribed medicines? "	0-200	181.50 (35.55)
Adherence to fluid restriction " During the past week, how often have you followed the fluid restriction recommendations? "	0-200	126.00 (71.23)
Adherence to dietary restriction " During the past week, how many times have you followed the diet recommendations? "	0-200	142.25 (65.18)
Total adherence score	0-1200	984.88 (174.20)

Total score=summation of the 6 questions..

Table 3. The adherence categories according to the ESRD-adherence questionnaire

Adherence categories	Frequency	Percent
Good	122	61.0
Moderate	66	33.0
Poor	12	6.0
Total	200	100.0

Poor adherence=< 700; **Moderate adherence** =700-999; **Good adherence** =1000-1200.

All patients perceived their hemodialysis management as highly/very important. Similarly, almost all (96%) of patients perceived their adherence to medicines as high/very important. On the other hand, some patients perceived their adherence to the recommended diet as moderately (7%) or less important (7%). Similarly, fluid intake restriction was less popular compared to the adherence to hemodialysis and medicines since 13% perceived limiting fluids as moderate important and 2% perceived it as with little or no importance. The highest score (4.82± 0.39) of perceive importance was for the adherence to hemodialysis while the lowest score was for limiting fluids intake (Table 4).

Table 4.The importance perceptions of following the recommended dialysis, medicines, fluid and food.

Items	Highly/Very important N (%)	Moderately important N (%)	Little/Not important N (%)	Mean of score (SD)
" How important do you think it is to follow your dialysis schedule? "	200 (100%)	0.0 (0.0%)	0.0 (0.0%)	4.82 (0.39)
" How important do you think it is to take your medicines as scheduled? "	192 (96%)	8 (4%)	0.0 (0.0%)	4.74 (0.53)
" How important do you think it is to limit your fluid intake? "	170 (85%)	26 (13%)	4 (2%)	4.38 (0.82)
" How important do you think it is important for you to watch your diet daily? "	172 (86%)	14 (7%)	14 (7%)	4.51 (1.04)
Total perception of therapy importance score	18.44 ± (1.71)			

Highly important=5; Very important =4; **Moderately important** =3; **Little important=2; Not important** =1.

Age out of eight characteristics (independent variables) had significant (P-value< 0.05) positive association with the total score of management adherence (outcome variable) according to the multiple linear regression. That means when the patient age increase, the total management adherence score increases as well (Table 5).

Table 5. Multiple linear regression of factors influencing the total score of management adherence

Predictor (independent variable)	Standardized Coefficients	P-value
	Beta	
Age (years)	0.208	0.016*
Gender	-0.075	0.321
Social status	-0.032	0.688
Education level	-0.113	0.161
Living place	-0.057	0.435
Profession	0.030	0.715
Total medications	0.037	0.616
Total comorbidities	-0.124	0.104

Dependent Variable: Total adherence score. R Square=0.164. *Significant at the 0.05 level.

Four items in the ESRD-AQ were about frequency of counseling received by patients for different treatment modalities (Table 6). The negative answers were "never, rarely, irregularly or only when there are an abnormal test results". Collectively, these negative answers represented 58.5% of answers concerning how importance is to follow a proper diet, 54.5% about the importance of dialysis treatment, 41.0 % about the importance of fluid restriction and 25.0% about the importance of taking their medications as prescribed.

Table 6. Frequency of counseling received by patients for different treatment modalities

Items	Every dialysis treatment N (%)	Every week N (%)	Every month N (%)	Every 2 to 3 months N (%)	Every 4 to 6 months N (%)	When I have abnormal blood or other test results N (%)	Rarely N (%)	Irregularly N (%)	Never N (%)	Other (Specify) N (%)
A	8 (4)	14 (7)	56 (28)	9 (4.5)	3 (1.5)	40 (20)	33 (16.5)	12 (6)	24 (12)	1 (0.5)
B	7 (3.5)	16 (8)	108 (54)	17 (8.5)	2 (1)	24 (12)	12 (6)	10 (5)	4 (2)	-
C	18 (9)	16 (8)	68 (34)	14 (7)	1 (0.5)	39 (19.5)	16 (8)	12 (6)	15 (7.5)	1 (0.5)
D	3 (1.5)	7 (3.5)	60 (30)	11 (5.5)	2 (1)	69 (34.5)	27 (13.5)	9 (4.5)	12 (6)	-

Item A: " How often does a medical professional (your doctor, nurse, dietician, or other medical staff) talk to you about the importance of staying for the entire dialysis time during your dialysis treatment? " **Item B:** " How often does a medical professional (your doctor, nurse, dietician or other medical staff) talk to you about the importance of taking medicines as ordered? " **Item C:** " How often does a medical professional (your doctor, nurse, dietician or other medical staff) talk to you about the importance of fluid restriction? " **Item D:** " How often does a medical professional (your doctor, nurse, dietician or other medical staff) talk to you about the importance of following a proper diet? "

Discussion

To manage the ESRD successfully, HD patients should be adherent for many all aspects of their treatment including complete attendance to HD, adherence to the prescribed medications, fluid restrictions, and dietary advices [(13)]. In this study, adherence behaviors of ESRD patients on chronic HD were measured and analyzed.

Based on demographic results of the current study (Table 1), the majority of HD patients had low socioeconomic status, as demonstrated by the high unemployment level (71.5%), low monthly income (66.5% had less than 0.5 million Iraqi Dinars), and low educational levels. Comparable findings were found in a study conducted in Saudi Arabia in which high levels of unemployment (66.20%), low monthly incomes (72.85%), and low educational levels were found among HD patients at governmental kidney centers [(14)].

The ESRD-AQ which was used in the current study is the first tool to measure all components of adherence behaviors of ESRD patients and it is reliable, valid and easy to administer [(15)]. Relatively high scores of adherence for (HD–attendance, episode of HD-shortening and duration of HD-shortening if shortened). In contrast, the lowest reported adherence score (126.0 out of 200) and (142.25out of 200) were for following the fluid restriction and dietary recommendations, respectively (Table 2). Generally, adherence to different HD treatment modalities was less than optimum with 39.0% of HD patients had an overall score corresponding to moderate/or poor adherence (Table 3). This finding is comparable to a study conducted in Palestine and found about 45.0% of HD patients had these two suboptimum adherence levels [(12)].

Adherence to dietary advices and fluid restriction is very important for success of treatment [(13)]. Non-adherence may increases complication rates, healthcare costs, and decreased survival [(16-18)]. The

findings that HD patients are more adherent to dialysis than dietary or fluid restrictions are similar to previous studies [19-21]. This may be related to the need for higher motivations and more appropriate skills and knowledge to follow dietary and fluid advice. In addition, the lowest reported adherence score for following the fluid restriction and dietary recommendations is supported and may be partially explained by the finding that perception of importance of following the fluid and dietary recommendations were the lower compared to perceptions toward adherence to medications and HD sessions (Table 4).

Age out of eight characteristics (independent variables) had significant (P-value< 0.05) positive association with the total score of management adherence (outcome variable) according to the multiple linear regressions. That means when the patient age increase, the total management adherence score increases as well (Table 5). Other previous studies have also showed that older age was associated with more adherence to fluid restriction and prescribed medications [19, 22, 23].

Furthermore, it has also been reported that dietary adherence of dialysis patients improves with older age,19,20 and the odds of missing at least one dialysis session in a month were higher in patients aged <55 years [24]. Possible explanations may be that the younger patients may perceive themselves as less liable for the negative health consequences while, on the other hand; older patients may possess more organized lifestyle that accommodates different treatment regimen demands [25], confirming the occurrence of an ‘‘intentional non-adherence’’ [26]. The finding that young patients are more likely to be non-adherent to treatment may be associated with poorer QOL in the future and higher mortality rates among these HD patients. In the current study, marital status and level of education were not found to be a detrimental factors for adherence. In contrast, other studies have found a positive role for marital status [8, 27] and education [7] on level of adherence.

Regarding the frequency of counseling received by patients for different treatment modalities. The negative answers were less than optimum for all treatment modalities with negative answers ranging from 25.0- 58.5% (Table 6). It seems that patients’ counseling are important in building patients’ general perception for various treatment modalities which may significantly affect their adherence.

The current study had a few limitations. The first limitation was incorporating HD patients from only two centers in Baghdad city, so the data did not fully represent all Iraqi HD patients. Second limitation was the self-reported design of the questionnaire used in the current study. Studies showed that there may be a disagreement between the actual adherence and the self-reported adherence [28,29]. The third limitation was its cross-sectional nature. A longitudinal study design might be better suited to establish causal relationships and would help to investigate changes of over time.

Conclusions

The current study showed that the overall adherence of HD patients to different treatment modalities was less than optimum with fluid and diet adherence representing the most challenging aspects in the health care of hemodialysis patients. Finally, older patients had higher odds of being more adherent.

References

1. Genevra G., Amy B. Health Literacy and Medication Management in Chronic Kidney Disease. Health Literacy Research and Practice . 2017; 1 (3):e109-e115.
2. Boris B., Caroline A., Andrew S., Mari S., Amir A., Molla A., *et al*. Chronic Kidney Disease Collaboration. Global, regional, and national burden of chronic kidney disease, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2020; 395: 709-733
3. Leila M., Taraneh T., Jamshid R., Mehrab S. End-stage renal disease in the Middle East: a systematic review and meta-analysis. Iranian Journal of Kidney Diseases. 2018;12(4):195-203.
4. Nurten O., Fatma I., Dilek A., Dilek M., Turker T., Nonadherence in Hemodialysis Patients and Related Factors: A Multicenter Study. The Journal of Nursing Research. 2019; 27 (4): 1-11.
5. WHO. Adherence to Long‐Term Therapies, Evidence for Action. 2003. Available at: http://apps.who.int/iris/bitstream/10665/42682/1/9241545992. (Accessed 10/5/2021).
6. Une E., Astrid K., Lasse G., Kristin H. Health literacy in kidney disease: associations with quality of life and adherence. Journal of Renal Care. 2020; 46(2): 85–94.
7. Christiane K., Ilona M., Cynthia L. Non-adherence in patients on chronic hemodialysis: an international comparison study. Journal of Nephrology. 2011; 24(03): 366-375.
8. Abdulmalik M., Sarah M., Najla A., Abdulkareem M., Shemylan A., Fayze F., *et al*. Medication Adherence among Adult Patients on Hemodialysis. Saudi J Kidney Dis Transpl. 2014;25(4):762-768.
9. Mina Q., Mohammad A., Reza R., Abbas R. Health Literacy and Medical Adherence in Hemodialysis Patients: The Mediating Role of Disease-Specific Knowledge. Thrita. 2015;4(1): 1-6.
10. Leslie R., Summer L., Kelly B., Robin D. The challenge of patient adherence. Therapeutics

and Clinical Risk Management. 2005:1(3) 189 –199.

11. Graffigna G, Barello S, Bonanomi A. The role of patient health engagement model (PHE-model) in affecting patient activation and medication adherence: a structural equation model. PLoS One. 2017;12(6): 1-19.

12. Karam S, Mohammad A., Moutaz W, Samah W, Waleed M., Sa'ed H. Treatment adherence and perception in patients on maintenance hemodialysis: a cross – sectional study from Palestine. BMC Nephrology. 2017; 18 (178): 1-9.

13. Kammerer J, Garry G, Hartigan M, Carter B, Erlich L. Adherence in patients on dialysis: strategies for success. Nephrology Nursing Journal. 2007;34:479-486.

14. Ghanim H. Prevalence of treatment adherence among attendance at hemodialysis in Makah. International Journal of Medical Science and Public Health. 2014; 3 (5): 592-598.

15. Youngmee K., Lorraine S., Linda R., Carol P., Joel D. The End-Stage Renal Disease Adherence Questionnaire (ESRDAQ): Testing The Psychometric Properties in Patients Receiving In-Center Hemodialysis. Nephrology Nursing Journal. 2010; 37(4): 377–393.

16. Walser M. Is there a role for protein restriction in the treatment of chronic renal failure? Blood Purif. 2000;18:304-312.

17. 17-Unruh M., Evans I., Fink N., Powe R., Meyer K. Skipped treatments, markers of nutritional nonadherence, and survival among incident hemodialysis patients. Am J Kidney Dis. 2005;46:1107-1116.

18. Tentori F, Hunt WC, Rohrscheib M, Min Z., Stidley C., Karen S., *et al.* Which targets in clinical practice guidelines are associated with improved survival in a large dialysis organization?. Journal of the American Society of Nephrology. 2007;18:2377-2384.

19. Kim Y, Evangelista L. Relationship between illness perceptions, treatment adherence, and clinical outcomes in patients on maintenance hemodialysis. Nephrology Nursing Journal. 2010; 37(3): 271–280.

20. Lam L., Twinn S., Chan S. Self-reported adherence to therapeutic regimen among patients undergoing continuous ambulatory peritoneal dialysis. Journal of Advanced Nursing. 2010; 66(4): 763–773.

21. Mok E., Tam B. Stressors and coping methods among chronic haemodialysis patients in Hong Kong. Journal of Clinical Nursing. 2001; 10(4): 503–511.

22. Kara B., Caglar K., Kilic S. Nonadherence with diet and fluid restrictions and perceived social support in patients receiving hemodialysis. Journal of Nursing Scholarship. 2007; 39(3): 243–248.

23. Park K., Choi K., Sim Y., Kim S. Comparison of dietary compliance and dietary knowledge between older and younger Korean hemodialysis patients. Journal of Renal Nutrition. 2008; 18(5): 415–423.

24. Obialo C., Hunt W., Bashir K., Zager P. Relationship of missed and shortened hemodialysis treatments to hospitalization and mortality: Observations from a US dialysis network. Clinical Kidney Journal 2012;5:315-319.

25. Kutner N. Improving compliance in dialysis patients: does anything work?. Seminars in Dialysis. 2001; 14(5): 324–327.

26. Hussey LC, Gilliland K. Compliance, low literacy, and locus of control. Nursing Clinics of North America. 1989; 24(3): 605–611.

27. Sabi K., Noto-Kadou-Kaza B., Amekoudi Y., Tsevi M., Sylla F., *et al*. Medication adherence of 65 patients in hemodialysis in Togo. Me´decine et Sante´ Tropicales. 2014 ; 24 : 172-176.

28. Katherine K., Maria V., Benjamin A., Susan E., Anne W., Vicki H., *et al*. The agreement of patient-reported versus observed medication adherence in type 2 diabetes mellitus (T2DM). BMJ Open Diabetes Research and Care. 2016;4(1): 1-5.

29. Harsha T., Nalyn S., Rachel C., Cristian P., James P., John E., *et al*. Differences between self-reported and electronically monitored adherence among patients receiving antiretroviral therapy in a resource limited setting. AIDS. 2012;26(18):2399–403.