

Evaluation of Dialysis Adequacy in Hemodialysis Patients: A Systematic Review

Hengameh Barzegar¹, Mahmood Moosazadeh², Hedayat Jafari³,
Ravanbakhsh Esmaili^{4*}

Purpose: Hemodialysis is the common kidney replacement therapy in Iran. Doing an adequate and effective dialysis can improve patients' quality of life and reduce kidney failure complications. Additionally, dialysis quality is an important factor in reducing mortality in patients with chronic kidney failure. This systematic review has investigated the adequacy of dialysis in studies done on hemodialysis patients of Iran.

Materials and Methods: All articles related to the dialysis adequacy in hemodialysis patients in English and Farsi (contemporary Persian) were identified by searching the related keywords in various electronic databases. According to the inclusion criteria, 21 studies were identified. The results were analyzed using Stata software version 11.

Results: A number of 6677 patients had been enrolled in 21 studies that were chosen for this systematic review. Based on the random effects model, the overall dialysis adequacy (KT/V) (K: clearance of urea, T: duration of dialysis, V: distribution of urea) more than 1.2 and its confidence interval were 36.3% and 26.4-46.2, respectively. Also, based on random effects model more than 65% urea reduction ratio in all studies was 28.8% and the confidence interval was 14.4-43.3.

Conclusion: KT/V and urea reduction ratio were much less desirable in hemodialysis patients and the dialysis quality was also undesirable. It seems that inadequate dialysis prescription, use of inappropriate filters, low pump speed (blood flow speed), and the short duration and few times of dialysis are the major causes of this inadequacy.

Keywords: dialysis adequacy; hemodialysis; systematic review; kidney failure

INTRODUCTION

Increased burden of chronic diseases is an existing challenge in the health systems worldwide.⁽¹⁾ Chronic kidney failure is a progressive and irreversible disorder in the kidney function in which the body's ability to maintain fluid and electrolyte balance and metabolic waste excretion is lost, ultimately leading to uremia.⁽²⁾ The advanced stage of the disease is known as end stage kidney disease.⁽³⁾ Until the middle of twentieth century, people who suffered from the kidney failure were helpless people who were waiting for their fate, but not death.⁽⁴⁾ Today, in Iran and many countries, the most common treatment method is hemodialysis. The purpose of dialysis is to remove the excess material and stabilize body's internal environment as well as removing the toxins that cause permanent injury.⁽⁵⁾ By the end of 2014, 70% of patients with chronic kidney failure were on hemodialysis. Also by that time the number of dialysis patients in Iran was around 27,457 people, of which about 25,934 patients (94%) were treated by hemodialysis.⁽⁶⁾ Several factors affect the survival in end-stage kidney disease patients including the cause of disease, alternative medicine, synchronism of other diseases such as cardiovascular disease and dialysis adequacy.⁽⁷⁾ Dialysis quality is a predictor of mortality in dialysis patients. Evidences suggest that when there is enough

effective hemodialysis treatment, there is less mortality in patients with kidney disease.⁽⁸⁾ By improving the dialysis adequacy, uremic complications and their effects on different organs will be reduced. Therefore, increasing dialysis quality is effective on various aspects of life in patients with chronic kidney failure. If it is improved, a lot of physical health problems and subsequent psychosocial problems will be solved.⁽⁹⁾ The most accepted methods for determining dialysis adequacy are the KT/V standard (K: clearance of urea, T: duration of dialysis, V: distribution of urea) and urea reduction ratio (URR).⁽¹⁰⁾ According to Renal Physicians Association and the National Kidney Foundation's disease outcomes quality initiative, the dialysis quality results using KT/V and URR are preferred because they reflect urea removal more accurately. Several studies have shown that if the rate of KT/V reaches 1.2 or URR is more than 65%, this is effective in improving dialysis patients' prognosis.⁽¹¹⁾ Today, doing a correct and reasonable dialysis can prevent many complications and also by preventing repeated hospital stays and applying the savings on healthcare costs, it can provide better quality of life for dialysis patients.⁽¹²⁾ There are different statistics about dialysis adequacy in Iran and there is still no general estimation. According to electronic searches, several studies with different

¹ School of Nursing and Midwifery, Student Research Committee, Mazandaran University of Medical Sciences, Sari, Iran.

² Health Sciences Research Center, Mazandaran University of Medical Sciences, Sari, Iran.

³ Department of Medical-Surgical Nursing, Mazandaran University of Medical Sciences, Sari, Iran.

⁴ Department of Medical-Surgical Nursing, Orthopedic Research Center, Mazandaran University of Medical Sciences, Sari, Iran.

*Correspondence: Department of Medical-Surgical Nursing, Orthopedic Research Center, Mazandaran University of Medical Sciences, Farahabad Road, Sari, Iran.

Tel: +98 113 336 7341. Fax: +98 113 336 7341. E-mail: r.esmaili90@gmail.com.

Received December 2015 & Accepted February 2016

Table 1. Characteristics of studies included in this systematic review

	First Author	Year	Journal Title	Language	Number of patients	KT/V > 1.2 Percentage	URR > 65% Percentage
1	Lesanpezheshki M	2001 CE(1380 H)	Feyz	Persian	37	18.9	-
2	Delavari A.R	2001 CE (1380 H)	Sci J Kurdistan Univ Med Sci	Persian	62	21.1	-
3	Shahbazian H	2002 CE (1381 H)	Sci Med J	Persian	74	-	-
4	Taziki O	2003 CE (1382 H)	J Mazandaran Univ Med Sci	Persian	50	-	-
5	Mozafari N	2005 CE(1383 H)	Res Sci J Ardabil Univ Med Sci	Persian	70	10	-
6	Afshar R	2006 CE(1385 H)	Iran J Pathol	English	54	33.3	11.1
7	Mousavi Movahed T	2007 CE(1386 H)	Qom Univ Med Sci J	Persian	238	44.5	21
8	Monfared A	2008 CE(1387 H)	J Guilan Univ Med Sci	Persian	139	76.3	72.7
9	Pourfarziani V	2008 CE (1387 H)	Saudi J Kidney Dis Transpl	English	338	-	-
10	Hojat M	2009 CE(1388 H)	J Crit Care Nurs	Persian	68	-	-
11	Raiesifar A	2009 CE(1388 H)	J Crit Care Nurs	Persian	45	2.3	6.6
12	Malekmakan L	2010 CE(1388 H)	Iran J Kidney Dis	English	632	32.1	-
13	Shariati A.R	2010 CE (1389 H)	J Gorgan Univ Med Sci	Persian	113	77.9	-
14	Moghareb M	2010 CE(1389 H)	J Birjand Univ Med Sci	Persian	50	5	6
15	Amini M	2011 CE(1389 H)	Iran J Kidney Dis	English	4004	43.3	-
16	Mohseni R	2011 CE(1390 H)	Hayat	Persian	50	14	10
17	Shasti S	2011 CE (1390 H)	Ebnesina	Persian	100	50.5	46
18	Hashemi M	2012 CE(1391 H)	J North Khorasan Univ Med Sci	Persian	63	47.5	36.1
19	Shariati A.R	2012 CE(1391 H)	JHPM	Persian	389	57.9	56.3
20	Abedi Samakoosh M	2013 CE(1392 H)	J Mazand Med Sci	Persian	60	41.7	20
21	Roozitalab M	2013 CE(1392 H)	Life Sci J	English	41	41.5	31.7

Abbreviation: URR, urea reduction ratio.

number of patients have investigated dialysis adequacy in different dialysis centers of Iran. The rising trend of chronic kidney disease and absence of adequate dialysis are the main causes of death in kidney patients. Thus, determining dialysis adequacy in hemodialysis patients can help to develop better healthcare. This study has systematically reviewed the studies which had been conducted on dialysis adequacy in Iran.

MATERIALS AND METHODS

The dialysis adequacy (KT/V and URR) in hemodialysis patients of Iran was estimated by a systematic literature review. The indexed articles in the available databases, including Magiran, scientific information database of Iran (SID), Google Scholar, Iranmedex, and Pubmed central, were used to find published studies on the subject. All studies were published in English and Farsi (contemporary Persian) between October 2000 and October 2014. The search was undertaken mainly

using keywords of dialysis adequacy in these two languages including hemodialysis adequacy, hemodialysis efficiency, and Iran with all possible combinations. The search with essential keywords was done using 'and' and 'or'. The search was carried out from 24 to 28 October 2014 by two researchers independently. Search evaluation was done by a member of the research team. The reference list of published studies was also studied to increase sensitivity and find the more articles.

Inclusion and exclusion criteria

The full text or abstracts of all papers and documents from the search were extracted. First the articles were evaluated based on title, author name, year and publication place and duplicates were removed. Then, the articles were carefully studied by researchers and the related articles were selected. Then irrelevant cases were removed. All studies were evaluated by the checklist. The list was designed using the contents of strengthening the reporting of observational studies in epidemiology

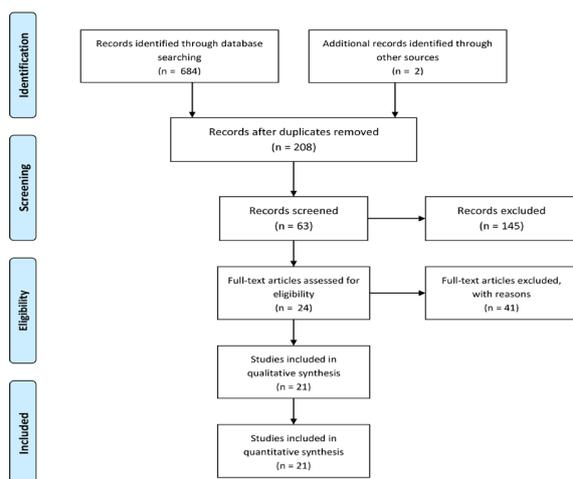


Figure 1. Flow chart of selecting studies for review.

gy (STROBE) list. The checklist included 12 questions that covered aspects of study design, sample size, age groups, sampling, objectives, study population, inclusion and exclusion criteria, matching samples method, analysis method, and presenting findings appropriately. Each question had one point and any study that had at least eight points entered our systematic review. All Farsi and English articles that determined dialysis adequacy in hemodialysis patients with KT/V standard > 1.2 and $URR > 65\%$ between 2000 and 2014 in Iran were selected. Studies which access to their full text was not possible, had insufficient data, were published before 2000, and were related to dialysis adequacy with variables such as quality of life and quality of sleep were excluded.

Data extraction

Data were obtained for each of the original studies by researchers based on the title, name of the first author, publication year, place of study, study design, sample size, average age of the population, $KT/V > 1.2$, and $URR > 65\%$.

Statistical Analysis

Data were transferred to the Stata software version 11 for analysis. The standard error for dialysis adequacy of patients in each study was calculated on the basis of a binomial distribution. The index of dissimilarity or heterogeneity between the studies was determined using Cochran (Q). According to the heterogeneity using the Meta command (Meta) in the meta-analysis the random effects model was used to assess dialysis adequacy. Additionally, to minimize the random distribution of studies' point estimates, all studies' findings were adjusted using the Bayesian analysis. The point estimate of the dialysis adequacy with 95% confidence interval was calculated in the accumulation graph (forest plots) that was the square size in this chart and it represented the weight of each study and for both sides with 95% confidence interval.

RESULTS

By searching in the databases including SID (68 cases), Magiran (55 cases), Pubmed (74 cases), Iranmedex (55 cases), Scopus (40 cases), Science direct (45 cases) and Google scholar (347 cases), a total number of 684

studies were found. By limiting the search with 'and' and 'or' operators, the number of articles was decreased to 342. In the initial review of the studies, 134 articles were excluded because they were duplicates, 145 studies were also excluded due to being non-relevant to the topic. In the second review after reading the abstracts and texts of 63 articles, 41 studies were again excluded. Two articles with a review of relevant articles were included in the study. Three researches were excluded after evaluating their full texts and lack of sufficient data. Finally, 21 articles that had the required criteria for a systematic review were included (**Figure 1**). Among the 21 articles in our systematic review, 20 studies were analytical and descriptive and only one study was a comparative study. 16 articles were in Farsi and five were in English. The details of the included studies are illustrated in **Table 1**. Thus, in this systematic review the dialysis adequacy was studied in 6677 hemodialysis patients. Optimal dialysis adequacy (KT/V more than 1.2) was from 2.3% in Raisifar et al. study with 45 patients to 77.9% in Shariati et al. study with 113 patients. The overall dialysis adequacy was also estimated using a random effects model (I-squared = 98.1%, $Q = 822.6$, $P < 0.001$), (26.4-46.2, 36.3%) (**Figure 2**). URR was between 5% in Moghareb's study and 72.7% in Monfared's study. Additionally, the URR of all studies was estimated using random effects model (I-squared = 97.5%, $Q = 396.5$, $P < 0.001$), (14.4-43.3, 28.8%) (**Figure 3**). The secondary objectives were also evaluated in the studies including: sex, age, dialysis times per week and its duration. The relationship between gender and dialysis adequacy was assessed in the reviewed studies. Nine studies showed significant differences.^(8,11-18) Dialysis adequacy was higher in women than men and also no significant difference was observed in seven researches.^(9,19-24)

The average ages of the studied populations in all studies were from 47.07 years in the Ruzitalab's study in Yasouj to 62.27 years in Shasti's study in Tehran. A significant difference was observed in two studies which had investigated the relationship between age and dialysis adequacy. Thus dial-

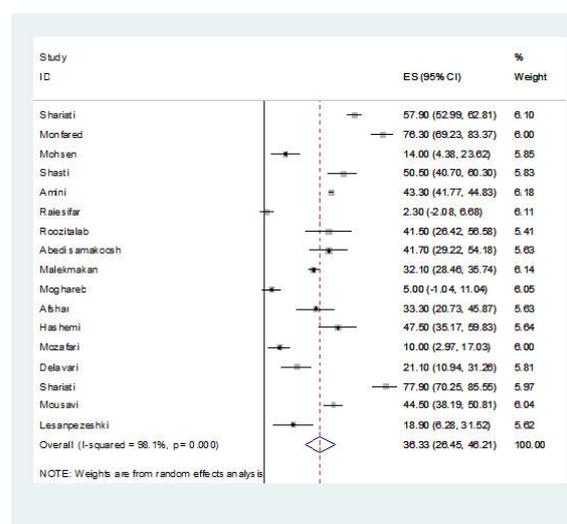


Figure 2. Frequency of $KT/V > 1.2$ in hemodialysis patients in each study and the overall estimate.

Abbreviations: CI, confidence interval; ES, effect size.

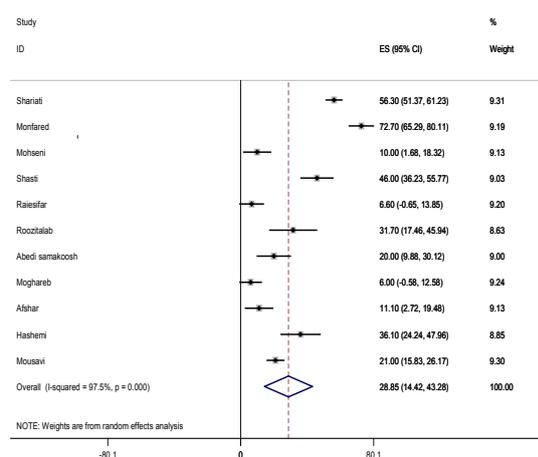


Figure 3. The frequency of hemodialysis patients in each study and the estimated URR.

Abbreviations: CI, confidence interval; ES, effect size.

ysis adequacy had reduced with increase of age.^(11,25) The relationship between dialysis times per week and dialysis adequacy was significant in three studies.^(11,12,23) The studies showed that patients who were on dialysis three times a week had a higher dialysis adequacy. Also, there was no significant relationship between dialysis adequacy and dialysis history in any of the reviewed studies.

DISCUSSION

In this systematic review 6677 hemodialysis patients were studied from 21 studies. About 1/3 of population had KT/V and URR more than 1.2 and 65%, respectively. Their dialysis adequacy was optimal. Survey results have shown that being women, having an older age and dialysis times per week can affect dialysis adequacy. In Malekmakan and colleagues' study in Shiraz, 32.1% had KT/V at the optimal level.⁽¹⁸⁾ In Egypt, a study showed that 45% of patients had optimal level of dialysis adequacy on the basis of KT/V and URR criteria, while 44% of people had dialysis adequacy at an optimal level.⁽²⁶⁾ But the results in Great Britain and other European countries have been much better. The percentage of patients in Britain who had good URR has increased from 56% in 1998 to 86% in 2010.⁽²⁷⁾ Although national standards, internal investigations, and disease specific guidelines of the Ministry of Health of Iran have determined $KT/V > 1.2$ as the minimum acceptable quality of dialysis, the international standards are higher. For example, the Association of American Nephrologists has announced the KT/V level of 1.4 to 1.7.^(28, 29) Therefore, obtaining the minimum acceptable quality in Iran is difficult. In studies in various countries including Egypt, Spain, Poland, Thailand, and Sweden, the acceptable KT/V level have been 1.5, 1.9, 1.4, 1.8, and 1.3, respectively,^(30- 34) all of which are higher than standards in Iran. Therefore the results of Iranian studies on dialysis quality of hemodialysis patients are weaker compared to foreign studies. It seems that inadequate dialysis prescription, inappropriate use of filters, pumps with low speed (blood flow speed) and lack of time for dialysis are

major causes of this inadequacy. There were significant differences in dialysis adequacy between developed countries and Iran, to some extent that may result in repeated use of high- flux filter. Blood flow rate is higher in these countries compared to Iran. Rapid reduction of blood urea in the dialysis process with high blood flow may show the extracted urea level higher than the real rate because cells' urea does not have the adequate time to exit the cell and adjust with the extracellular fluids.⁽¹⁸⁾

In a review article in London, the average age of patients who did hemodialysis was from 45 to 64 years. This was 60.7 years in a study in Spain, 57.5 years in Abbas and colleagues' study in Egypt, and 61.7 years in Tyne and colleagues' study in China.^(30,35-37) These are consistent with our results. Since the patients' mean age in these studies was close, it is a guideline which shows the population at risk. Patients' age is an issue which should be considered in particular. Because chronic kidney failure patients are elderly with special conditions and needs of living, they need emotional and educational support. The results showed that as age increases, KT/V reduces. Therefore some decisions should be made to improve the quality of older patients' dialysis such as increasing hours of dialysis according to patient's tolerance, filter type, number of dialysis times per week, nutrition and physical activity. The results of our study showed that in some studies the dialysis adequacy in women was higher than men. This may be because of the using similar dialysis filters in both genders. Therefore it is better for women due to the smaller size, less weight and urea distribution. In this research the dialysis quality in patients who underwent dialysis, three times a week was more than those who did it twice a week. It seems that with changing treatment plans intended for dialysis patients from two to three times a week, the dialysis quality can be increased.

CONCLUSIONS

Most Iranian patients have KT/V and URR much lower than the desirable level. They also have undesirable dialysis qualities. The prevalence of this condition increases mortality in these patients. Due to the increase of chronic diseases such as diabetes and high blood pressure as a result of an increase in hemodialysis patients, it is necessary to increase dialysis adequacy. This can be done with a review of confounding factors such as nutrition diet, filter type, dialysis device, dialysis duration, patient education, and underlying disease. Thus, the medical costs can be reduced further and eventually the quality of life in hemodialysis patients can increase.

ACKNOWLEDGMENTS

The authors thank deputy of research of Mazandaran University of Medical Sciences who funded this study (Grant no: 1327). The authors would like to thank Seyed Muhammed Hussein Mousavinasab for his sincere cooperation in editing this text.

CONFLICT OF INTEREST

None declared.

REFERENCES

1. Karimi S, Javadi M, Jafarzadeh F. Economic burden and costs of chronic diseases in Iran and the world. Director General. 2012;8(7):996.

- [in Persian]
2. Javanbakhtian Ghahfarokhi R, Abbaszadeh A. The relationship between quality of life and demographic variables in hemodialysis patients. *J Jahrom Univ Med Sci.* 2012; 10:1-6.
 3. dos Reis Santos I, Danaga AR, de Carvalho Aguiar I, et al. Cardiovascular risk and mortality in end-stage renal disease patients undergoing dialysis: sleep study, pulmonary function, respiratory mechanics, upper airway collapsibility, autonomic nervous activity, depression, anxiety, stress and quality of life: a prospective, double blind, randomized controlled clinical trial. *BMC Nephrol.* 2013; 14:215.
 4. Mottahedian-Tabrizi E, Najafi Mehri S, Samiey S, Einollahi B, Babaei GH, R, Mohammadi E. Effect of programmed nursing care in prevention of hemodialysis complications. *Iran J Crit Care Nurs.* 2009;2:55-9.
 5. Tayyebi A, Shasti S, Ebadi A, Eynollahi B, Tadrissi SD. The relationship between blood pressure and dialysis adequacy in dialysis patients. *J Crit Care Nurs.* 2012;5:49-54.
 6. Islamic Republic News Agency. Number of advanced kidney failure patients is increasing 6% annually in Iran. 20/07/2015. Available from: www.irna.ir/fa/News/81687836/. Retrived on 05/08/2015 [in Persian]
 7. Beladi MSS, Hosaini NK, Zeraati AA. The Evaluation of Dialysis Adequacy by KT/V in Hemodialysis Patients. *Jundishapur Sci Med J.* 2012;11:43-48.
 8. Abedi Samakoosh M, Aghaie N, Gholami F, Shirzad M, Yosefi E, Teymoorzadeh Baboli M. Assesment Dialysis Adequacy in Hemodialysis Patients of Qaemshar Razi Hospital in 2012. *J Mazand Med Sci.* 2013;23:20-7. [in Persian]
 9. Shariati A, Asayesh H, Nasiri H, et al. Comparison of dialysis adequacy in patient's that referred to Golestan province hemodialysis centers. *JHPM.* 2012;1:55-63.[in Persian]
 10. Eshghizadeh M, Basirmoghadam K, Baloochi Beydokhti T, Safarpour Gharib Z, Mokhtari S. Dialysis adequacy in diabetic and non-diabetic patients admitted to hospital in gonabad, Iran in 2012. *Med Surg Nurs J.* 2014;3:77-83. [in Persian]
 11. Mohseni R, Ilali ES. Assessment of Adequacy of Dialysis in Patients Undergoing Dialysis with Bicarbonate Solution. *Hayat.* 2011;17:63-72. [in Persian]
 12. Mogharab M, Madarshahian F, Rezai N, Mohammadi A. Dialysis adequacy in chronic hemodialysis patients in educational center Vali-Asr in Birjand. *J Birjand Univ Med Sci.* 2010;17:206-14. [in Persian]
 13. Afshar R, Jalali Nadoushan M, Sanavi S, Komeili A. Assessment of hemodialysis adequacy in patients undergoing maintenance maneuver by laboratory tests. *Iran J Pathol.* 2006;1:55-60. [in Persian]
 14. Amini M, Aghighi M, Masoudkabar F, et al. Hemodialysis Adequacy and Treatment in Iranian Patients. *Iran J .Kidney Dis.* 2011;5:103-9.
 15. Hashemi M, Garshad A. Assising the Adequacy of Dialysis and some biochemical Factors related to it in patient under Heamodialysis in Dialysis ward of Emam Ali Hospital Of Bojnourd. *J North Khorasan Univ Med Sci.* 2014;4:665-70. [in Persian]
 16. Hojjat M. Hemodialysis adequacy in patients with chronic renal failure. *J Crit Care Nurs.* 2009;2:61-6. [in Persian]
 17. Lesanpezesghi M, Matini S, Taghadosi M, Mousavi S. Dialysis adequacy in hemodialysis patients in Kashan. *Feyz.* 2001;5:82-7. [in Persian]
 18. Malekmakan L, Haghpanah S, Pakfetrat M, et al. Dialysis adequacy and Kidney Disease Outcomes Quality Initiative goals achievement in an Iranian hemodialysis population. *Iran J Kidney Dis.* 2010;4:39-43.
 19. Delavari AR, Sharifian A, Rahimi EA. Dialysis efficacy in three dialysis centers in Kurdistan province. *Sci J Kurdistan Univ Med Sci .* 2001;5:18-22. [in Persian]
 20. Monfared A, Orang Pour R, Kohani M. Evaluation of hemodialysis adequency on patient undergoing hemodialysis in razi hospital in Rasht. *J Guilan Univ Med Sci.* 2007;17:44-9. [in Persian]
 21. Raiesifar A, Torabpour M, Mohsenizad P, Shabani H, Tayebi A, Masoumi M. Dialysis adequacy in patients of Abadan hemodialysis center. *J Crit Care Nurs.* 2009;2:87-90. [in Persian]
 22. Roozitalab M, Mohammadi B, Najafi S, Mehrabi S, Fararouei M. KT/V and URR and the Adequacy of Hemodialysis in Iranian provincial hospitals: an evaluation study. *Life Sci J.* 2013;10:13-16.
 23. Shariati AR , Mojerloo M , Hesam M, et al. Hemodialysis efficacy in patients with end stage renal disease in Gorgan, Northern Iran 2008. *J Gorgan Univ Med Sci.* 2010;12:80-4. [in Persian]
 24. Shasti S, Baba Haji M. The assesment of dialysis adequacy among hemodialysis patients in tehran city. *Ebnesina.* 2011;14:23-7. [in Persian]
 25. Mousavi Movahed S, M, Komeili Movahed T, Komeili Movahed A, Dolati M. Assessment of adequacy of dialysis in patients under continuous hemodialysis in Kamkar and Hazrat Vali Asr hospitals, State of Qom, 2006. *Qom Univ Med Sci J.* 2007;1:45-52. [in Persian]
 26. Azar A. The influence of maintenance quality of hemodialysis machines on hemodialysis

- efficiency. *Saudi J Kidney Dis Transpl.* 2009;20:49-56.
27. Adas H, Al-Ramahi R, Jaradat N, Badran R. Assessment of adequacy of hemodialysis dose at a Palestinian hospital. *Saudi J Kidney Dis Transpl.* 2014;25:438-42.
 28. Fried L, Hebah N, Finkelstein F, Piraino B. Association of Kt/V and creatinine clearance with outcomes in anuric peritoneal dialysis patients. *Am J Kidney Dis.* 2008;52:1122-30.
 29. Gotch F. The basic, quantifiable parameter of dialysis prescription is Kt/V urea; treatment time is determined by the ultrafiltration requirement; all three parameters are of equal importance. *Blood Purif.* 2007;25:18-26.
 30. Abbas TM, Sheashaa HA, Saad MA, Sobh MA. Does provision of a higher Kt/V urea make a difference? A hemodialysis controversial issue. *Hemodial Int.* 2005;9:153-8.
 31. Chirananthavat T, Tungsanga K, Eiam-Ong S. Accuracy of using 30-minute post-dialysis BUN to determine equilibrated Kt/V. *J Med Assoc Thai.* 2006;89:54-64.
 32. Del Pozo C, López-Menchero R, Sánchez L, Álvarez L, Albero MD. Accumulated experience in the analysis of quality indicators in a haemodialysis unit. *Nefrología.* 2009;29:42-52.
 33. Grzegorzewska AE, Banachowicz W. Comparisons of Kt/V evaluated using an online method and calculated from urea measurements in patients on intermittent hemodialysis. *Hemodial Int.* 2006;10:5-9.
 34. Uhlin F, Fridolin I, Magnusson M, Lindberg LG. Dialysis dose (Kt/V) and clearance variation sensitivity using measurement of ultraviolet-absorbance (on-line), blood urea, dialysate urea and ionic dialysance. *Nephrol Dial Transplant.* 2006;21:2225-31.
 35. Maduell F, Vera M, Serra N, et al. Kt as control and follow-up of the dose at a hemodialysis unit. *Nefrologia.* 2008;28:43-47.
 36. Tian Xk, Wang T. Dissociation between the correlation of peritoneal and urine Kt/V with sodium and fluid removal: A possible explanation of their difference on patient survival. *Int Urol Nephrol.* 2005;37:611-4.
 37. Suri RS, Nesrallah GE, Mainra R, et al. Daily hemodialysis: a systematic review. *Clin J Soc Nephrol.* 2006;1:33-42.