ACHSM Asia-Pacific Journal of Health Management

REVIEW ARTICLE

DIALYSIS ADEQUACY AMONG HAEMODIALYSIS PATIENTS IN EASTERN MEDITERRANEAN REGION: A SYSTEMATIC REVIEW AND META-ANALYSIS

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ABSTRACT

INTRODUCTION:

Dialysis adequacy is one of the most important indicators for measuring the quality of care provided in hemodialysis (HD) wards. Despite individual studies, there is still no comprehensive study about dialysis adequacy in the Eastern Mediterranean Region (EMRO). This study was conducted to evaluate the dialysis adequacy in HD patients in the EMRO.

METHODS:

In the present systematic review and meta-analysis international (EMBASE, Scopus, PubMed, Web of Science) and national (SID, MAGIRAN) databases were searched for related articles using keywords "dialysis adequacy" and "EMRO" from 1 January 2000 to April 30, 2020. The quality of studies was studied using Hoy et al instrument.

RESULTS:

Out of 966 retrieved studies, 63 studies conducted on 15462 HD patients were included. The pooled mean of KT/V and URR were 1.24 (95% CI: 1.19, 1.30) and 63.03% (95% CI: 61.31, 64.75), respectively. The pooled prevalence of Kt/V>1.2 and URR>65.0% were 42.73% (95% CI: 31.58, 53.88) and 42.52% (95% CI: 25.3, 59.7), respectively.

CONCLUSION:

The results of the present study indicate the poor dialysis adequacy in the EMRO region and the need to improve the physical infrastructure, workforce, and pieces of equipment in hemodialysis wards.

KEYWORDS

Dialysis adequacy; Renal Failure; Eastern Mediterranean Region; Systematic review.

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INTRODUCTION

Today, end-stage renal disease (ESRD) is a major public health challenge worldwide. According to the latest results of the global burden disease study (GBD) in 2020, about 697 million people worldwide suffer from chronic kidney disease (CKD), which shows that the global prevalence of CKD is 13.4% [1]. Also, at the end of 2017, more than 1.2 million people lost their lives due to CKD [2]. More than 89% of ESRD patients use hemodialysis [3].

Hemodialysis in the long term causes negative effects on the psychological (fatigue, depression) [4,5] and physical dimensions (itching, musculoskeletal pain) [6,7]. It also causes a negative effect on the quality of care indicators in hemodialysis wards including anemia, nutritional disorders, and dialysis adequacy [8,9]. Achieving optimal dialysis adequacy is the main goal of the care provided [10].

Dialysis adequacy is used as a global standard to evaluate the performance of the dialysis machine and more generally as an indicator to evaluate the performance of the dialysis center and the rate of receiving appropriate health services [11]. Despite the importance of regular measurement of dialysis adequacy, the results of studies show that in developing countries, only one-third of patients undergo dialysis adequacy regularly [12].

Evidence for the Eastern Mediterranean shows that most countries do not have a dialysis registry [13]. Also, more than 34% of HD patients do not receive a target KT/V greater than 1.2 [13]. Individual studies also show that most patients have lower than standard dialysis adequacy. There is limited information on the adequacy of dialysis in the EMRO region. The studies performed are mostly individual. Determining the exact level of dialysis adequacy can help policymakers to determine the distance from global standards and plan to reduce this gap. Therefore, this study was performed to evaluate the dialysis adequacy in patients undergoing hemodialysis in the EMRO.

METHODS

1. ELIGIBILITY CRITERIA

This systematic review and meta-analysis was conducted based on Cochran's book and reported using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [14]. The protocol has been registered in PROSPERO (CRD42017057507). Studies performed on HD patients were included. Narrative Reviews, letters to the editor, qualitative studies, and published in none-English language were excluded. Dialysis adequacy was measured using KT / V and URR indices. According to the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (KDOQI), dialysis adequacy was considered as kt / v> 1.2 or URR above 65% [15].

2. SEARCH STRATEGY

In the present study, international (EMBASE, Scopus, PubMed, Web of Science) and national (SID, MAGIRAN) databases were searched from 1 January 2000 to April 30, 2020 in the peer-reviewed journals. The search strategy was developed with the help of a librarian with experience in systematic review studies. The search strategy developed for the PubMed database for searching other databases was modified and used. Boolean operators (AND, OR, and NOT), Mesh related keywords, truncation "*" and related text words were used for search in title and abstract using the following keywords: "Dialysis adequacy" AND "EMRO region countries". Supplementary Table 1. EMRO countries were defined based on the WHO category.

3. SELECTION OF STUDIES AND DATA EXTRACTION

Based on the study protocol, the two researchers separately reviewed the titles. The consensus method was used for solving controversies among two researchers. At first, duplicate studies were eliminated, then the remaining studies were evaluated concerning the overall purpose of the study. Then, based on the eligibility criteria the title and abstract of the articles were reviewed. In the last stage, the Full Text of the remaining articles was evaluated and the final articles were selected. In cases where the necessary information was not available in the studies, the authors of the studies were contacted. The extracted information was entered into Excel. The items extracted were: Author, Year of publication, Country, sampling method, method of dialysis adequacy measurement (kt/v, URR), Design, number of participants, Age (mean+SD), gender (male /female), Risk of bias, main outcomes (Kt/V mean, % and number of patients with kt/v> 1.2, mean of URR, and % and number of patients with URR>65%, Dialysis Session Length(DSL)(min), Intradialytic Weight Loss (kg) and risk of bias.

4. QUALITY ASSESSMENT AND DATA ANALYSIS

Assess the methodological quality and risk of bias of each included observational study were evaluated by using the

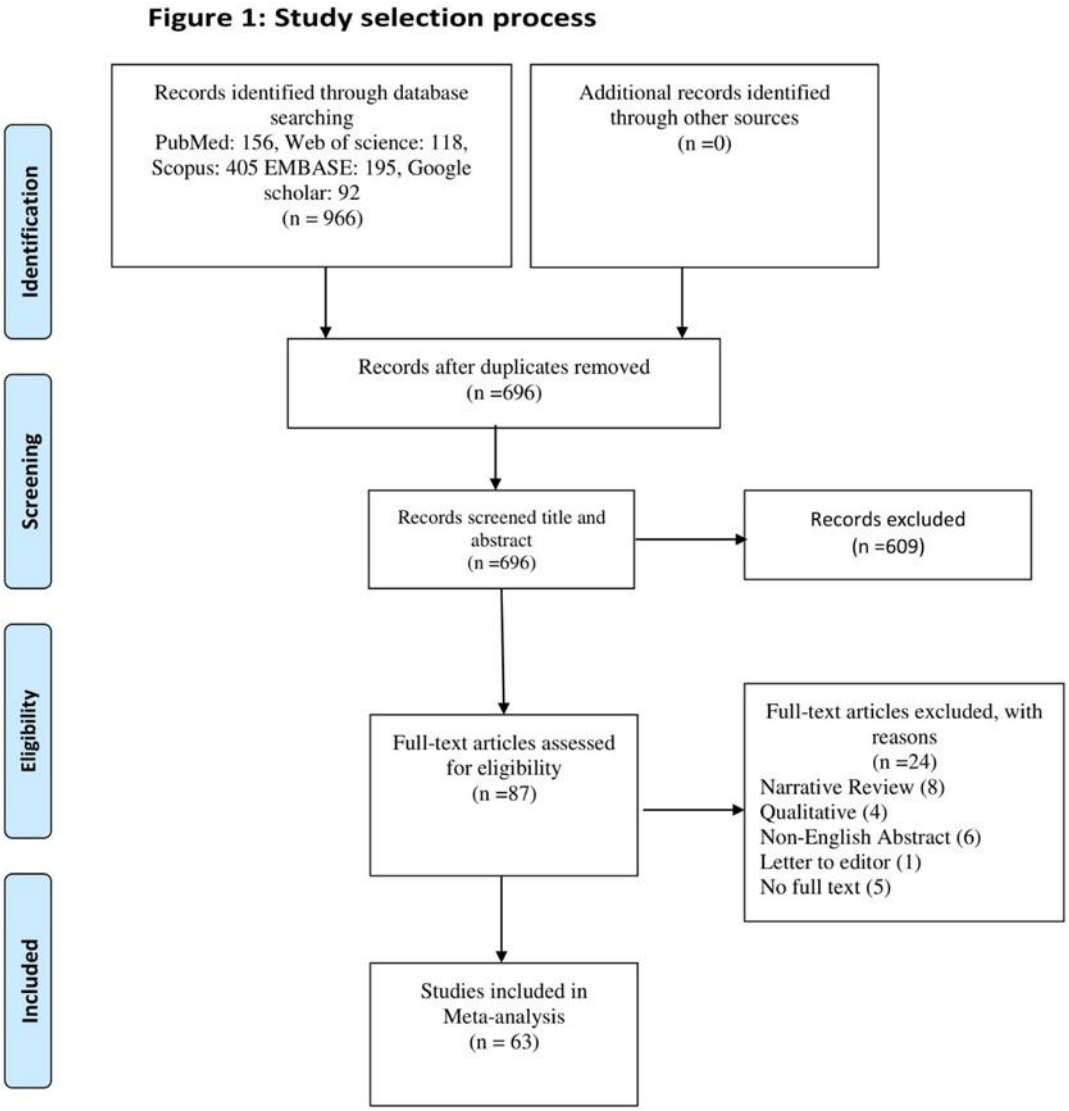
Hoy et al tool. This 10-items tool evaluated the quality of studies in two dimensions including external validity Internal validity Risk of bias was evaluated by two researchers independently, Disagreements were resolved through the consensus method. All the eligible studies were included in the synthesis after a systematic review. Data were combined with the forest plot. The overall dialysis adequacy was evaluated by a random-effects model. The heterogeneity of the preliminary studies was evaluated with I2 tests. Sub-group analysis was conducted to determine heterogeneity based on the study gender and age. Meta-analysis was performed using STATA 14 (StataCorp, Texas, USA) statistical software.

RESULTS

1. STUDY SELECTION

A total of 966 articles from initial searches have been retrieved in national and international databases. Out of 801 none-duplicated articles in the title and abstract screening process, 609 studies were excluded. Out of 87 studies, 63 had eligibility criteria. Out of 24 excluded studies, eight studies were narrative reviews, one study was a letter to the editor, five studies had not full text, four studies were qualitative, and six studies had not English abstract (Figure 1).

FIGURE 1: STUDY SELECTION PROCESS



2. STUDY CHARACTERISTICS

63 studies performed on 15462 HD patients entered the final stage. The highest number of studies was conducted in Iran (n = 35), Egypt, and Saudi Arabia (n = 9). In most studies (n = 55) the convenience sampling method was used to select the samples. Most studies were cross-sectional (n = 65) and had low bias risk (n = 63). Most participants were female and had a mean age of 49.2 ± 15.7 (age range: 39-61.7 years). (Table 1)

3. DIALYSIS ADEQUACY

Of the total included study, quantify hemodialysis and peritoneal dialysis treatment adequacy assessed by Kt/V in 46 studies, with 13744 participants. In these studies, the mean of Kt/V was between 0.68 and 2.19. Based on the results of the random effect method, the pooled mean of Kt/V was 1.24 (95% CI: 1.19, 1.30; I2=99.3%) (Figure 2).

The Kt/VOCM (Kt by OCM (Online Clearance Monitor) and V by Watson) were reported in three studies. In this study Kt/VOCM mean±SD was 0.93±0.32 [16], 1.02±0.15 [17] and 1.45±0.23 [18] and pooled mean was 1.13 (95% CI: 0.82, 1.45; I2=97.9%).

The urea reduction ratio (URR) as the fractional reduction of urea during dialysis, assessed and reported in 22 studies, with 7096 participants. In these studies, the mean of URR was between 54.4% and 81.3%. Based on the results of the random effect method, the pooled mean of URR was 63.03% (95% CI: 61.31, 64.75; I2=100%) (Figure 3).

The prevalence of Kt/V>1.2 as dialysis adequacy was reported in 30 studies. The dialysis adequacy based on this index was high heterogeneity and was between 4.86% to 97.95% in the included study. Based on the results of the random effect method, the pooled prevalence of Kt/V>1.2 was 42.73% (95% CI: 31.58, 53.88; I2=99.3%) (Figure 4).

The prevalence of URR>65.0% as dialysis adequacy was reported in 12 studies. The dialysis adequacy based on this index was high heterogeneity and was between 10.0% to 93.84% in the included study. Based on the results of the random effect method, the pooled prevalence of URR>65.0% was 42.52% (95% CI: 25.3, 59.7; I2=99.3%) (Figure 5)

FIGURE 2. THE FOREST PLOT AND POOLED MEAN KT/V AS A MARKER OF DIALYSIS ADEQUACY

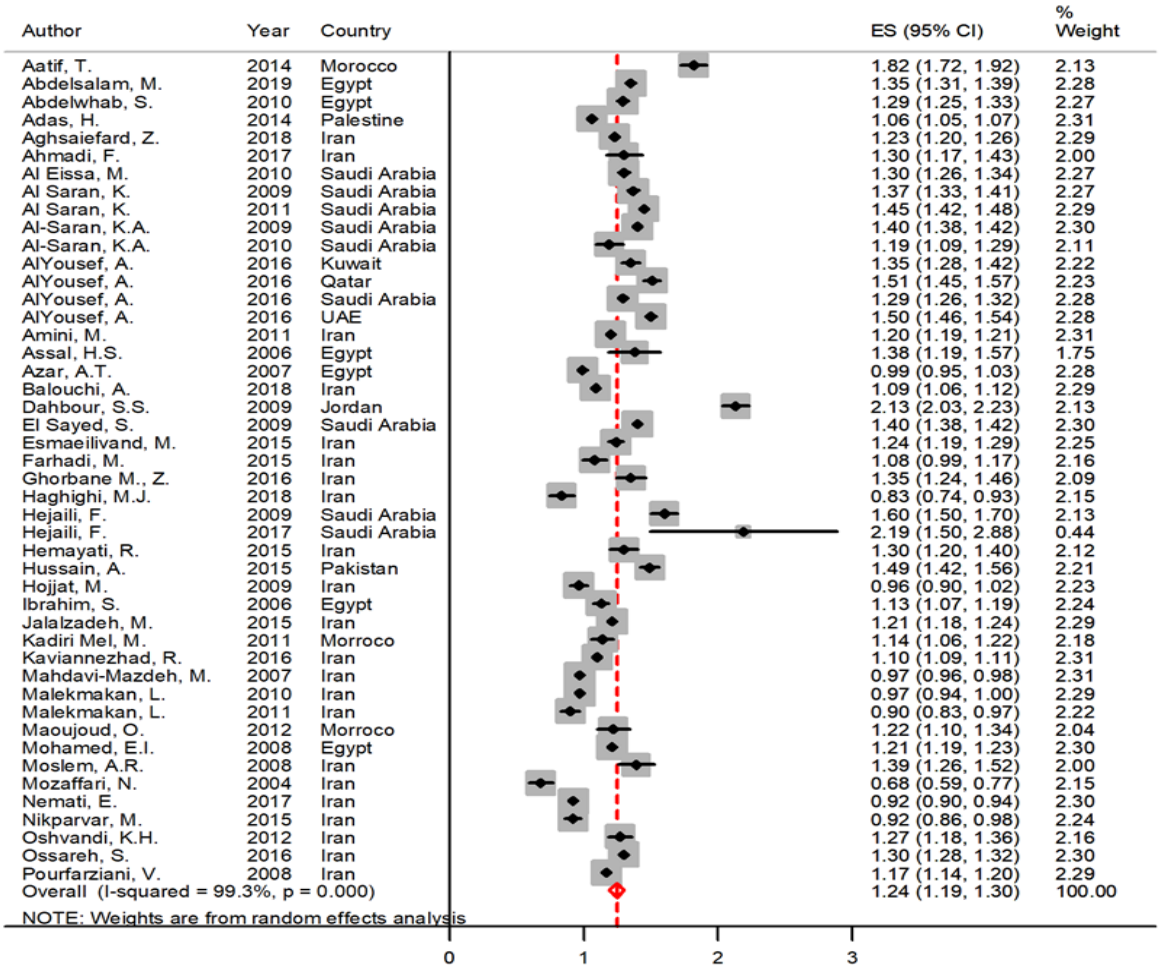


FIGURE 3. THE FOREST PLOT AND POOLED MEAN UREA REDUCTION RATIO (URR) AS A MARKER OF DIALYSIS ADEQUACY

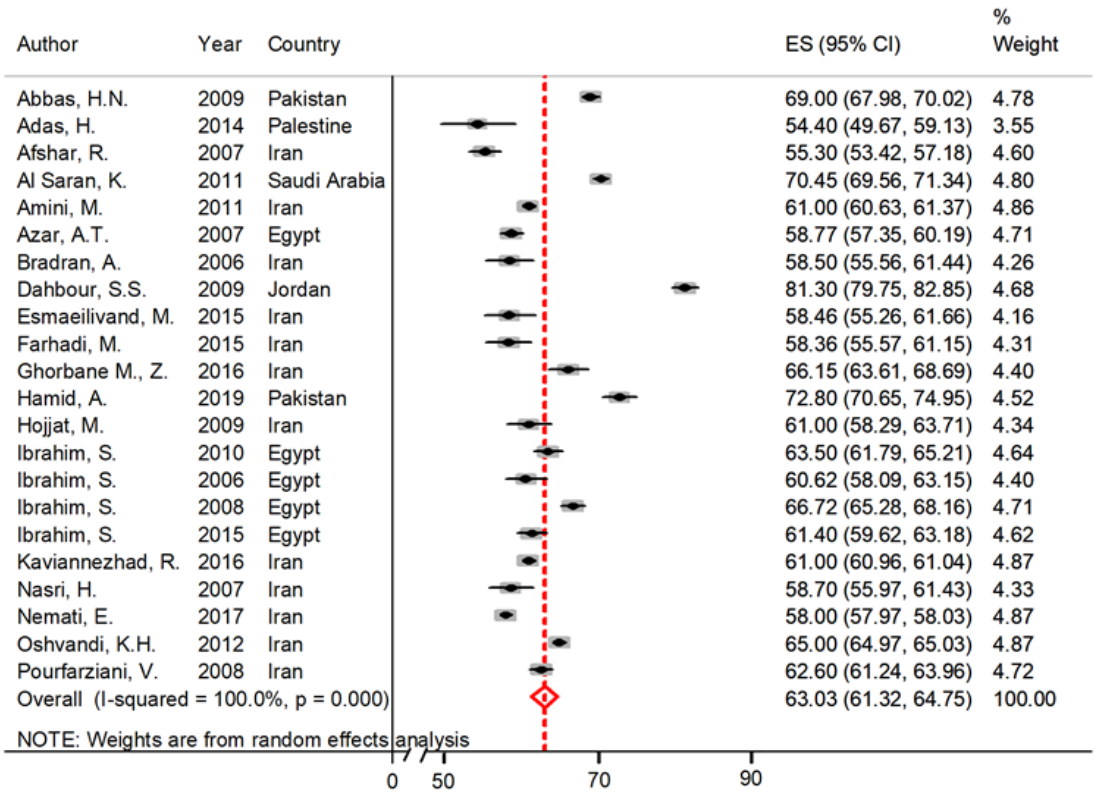


FIGURE 4. THE FOREST PLOT AND POOLED PREVALENCE OF KT/V>1.2 AS DIALYSIS ADEQUACY

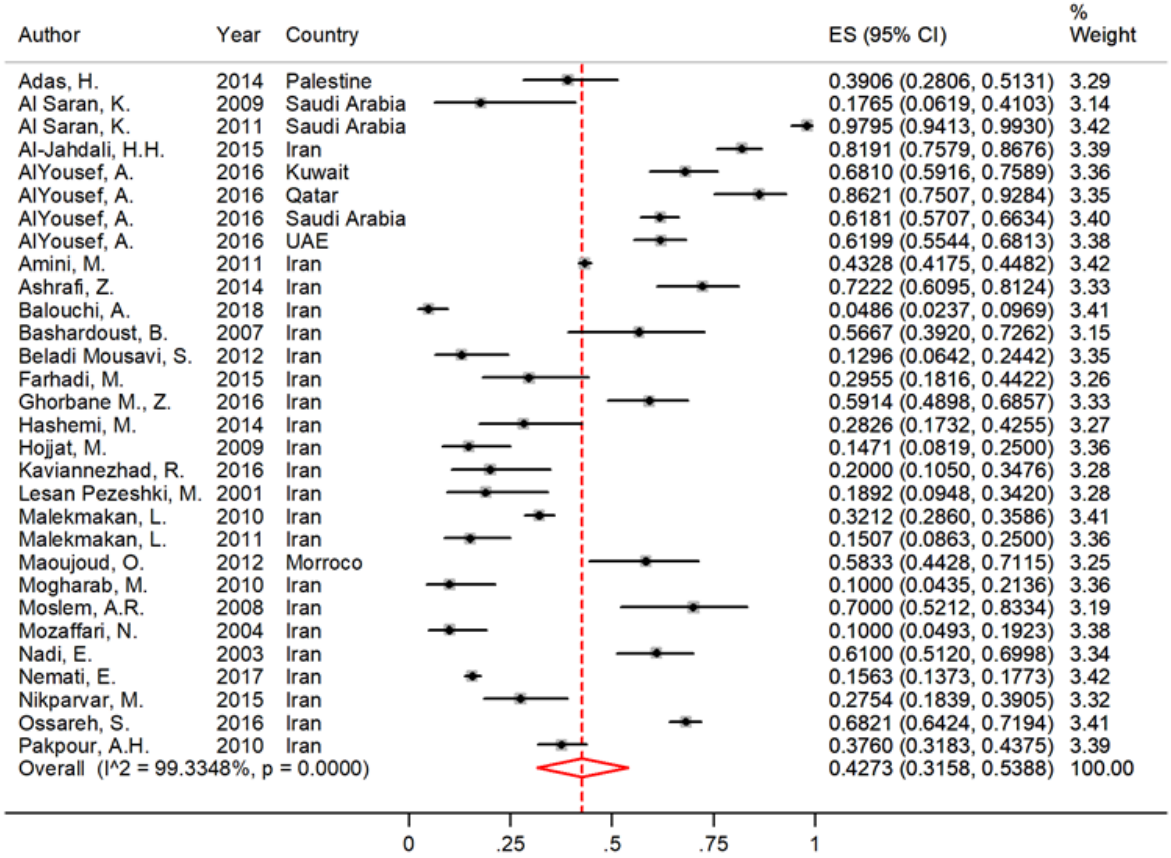
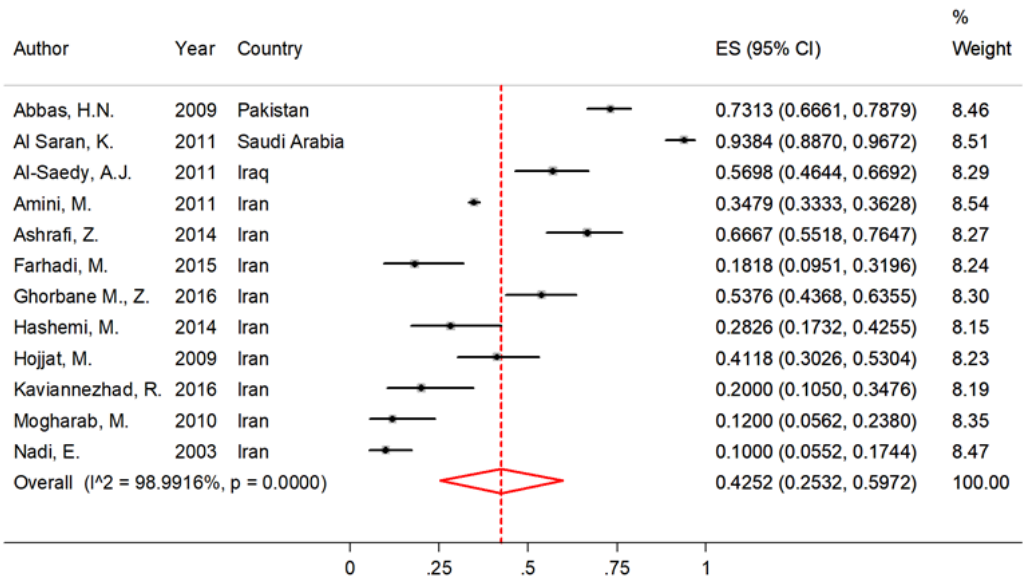


FIGURE 5. THE FOREST PLOT AND POOLED PREVALENCE OF URR>65% AS DIALYSIS ADEQUACY



The dialysis session length (DSL) and prescribed blood flow rate (ml/min) were reported in eight studies. The mean of this DSL time was between 202.0 to 245.2 min and pooled mean of this time (min) was 226.0 (95% CI: 218.8, 233.2; I2=97.0%). Also, the mean prescribed blood flow rate was between 242.9 to 310.0 ml/min and pooled mean of that was 277.9 (95% CI:260.2, 295.7; I2=99.0%) (Table 2).

4.META-REGRESSION

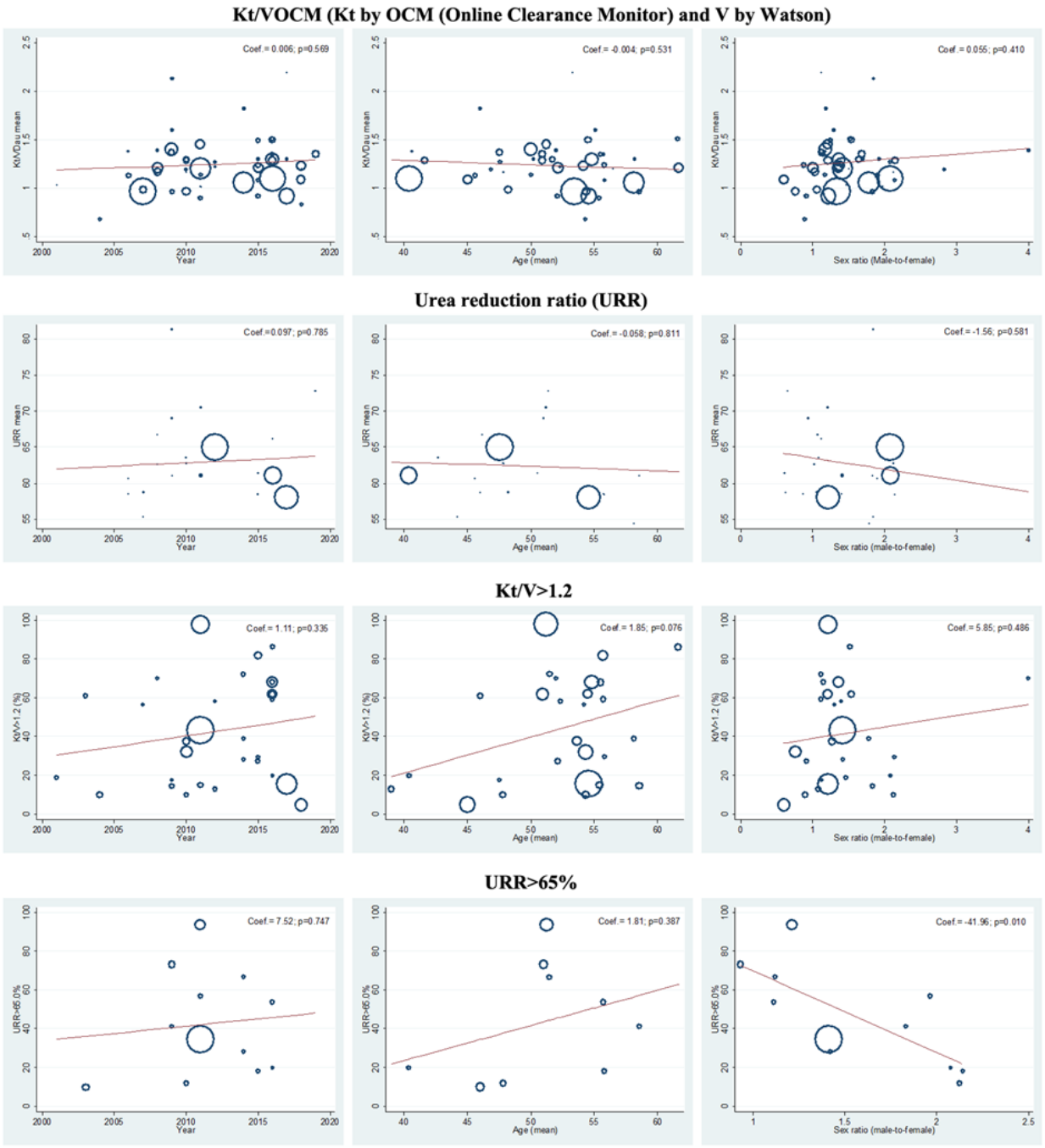
The results of univariate meta-regression analyses of Kt/V and URR showed a year of publication, mean age of participants, and gender (male-to-female ratio) variables not significantly contributed to the heterogeneity of Kt/V and URR mean score (P>0.05). Although, the mean age of participants for Kt/V>1.2 showed a marginally significant heterogeneity (Coef. =1.8, p=0.076), which explained 8.6% of the between-study variation. Also, gender (male-to-female ratio) for prevalence of URR>65% showed a significant heterogeneity (Coef. =-42.0, p=0.010), that explained 50.4% of between-study variation (Figure 6).

TABLE 2: META-ANALYSIS OF DIALYSIS SESSION LENGTH (MIN) AND PRESCRIBED BLOOD FLOW RATE (ML/MIN)

The first author (Year)	Country	Mean (95% CI)	
		Dialysis Session Length (min)	Prescribed Blood Flow Rate (ml/min)
Aatif, T. (2014)	Morocco	245.2 (241.1, 249.2)	291.1 (286.8, 295.4)
Adas, H. (2014)	Palestine	238.4 (235.3, 241.4)	
AlYousef, A. (2016)	Kuwait	219.0 (209.2, 228.8)	288.0 (275.3, 300.7)
AlYousef, A. (2016)	Qatar	230.0 (219.4, 240.6)	290.0 (272.2, 307.8)
AlYousef, A. (2016)	Saudi Arabia	202.0 (196.4, 207.6)	310.0 (295.2, 324.7)
AlYousef, A. (2016)	UAE	226.0 (220.5, 231.5)	284.0 (271.1, 296.9)
Amini, M. (2011)	Iran	229.2 (228.5, 229.9)	242.9 (241.7, 244.1)
Azar, A.T. (2007)	Egypt	216.6 (212.7, 220.5)	
Kaviannezhad, R.	Iran		245.4 (242.2, 248.6)
Overall pooled effect size (mean)		226.0 (218.8, 233.2)	277.9 (260.2, 295.7)

CI: Confidence interval

FIGURE 6. META-REGRESSION OF PUBLICATION YEAR, AGE, AND SEX RATIO (MALE-TO-FEMALE) FOR KT/V AND URR



DISCUSSION

Providing high-quality care is the most important goal of hemodialysis. This systematic review and meta-analysis study was performed to evaluate the dialysis adequacy in hemodialysis patients in the EMRO. 63 studies performed on 15462 people entered the final stage. The results of the meta-analysis showed that the mean Kt/V in patients undergoing hemodialysis in the EMRO is 1.24, which is in line with international standards. But compared to Turkey (1.61), North America (1.56, Europe (1.57) was at a lower level, which could be due to the different methods of dialysis adequacy measurement, the number of dialysis sessions in different countries [19]. The mean of dialysis adequacy based on URR was 63.3%, which is less than the standard level of 65%. Studies have shown that lower URR is associated with mortality and long-term hospitalization [20,21]. Also, the results of this study showed that more than 42% of patients in the Middle East region have a Kt/V >1.2, but in the previous meta-analysis study in Iran, only 28.8% of patients had a KT/V>1.2, which was lower than the present

study [22] which can be due to methodological differences (number of studies entered, diversity of countries under study and method of measuring dialysis adequacy) in the two studies, as well as changes in the number of services provided to patients during this period. Individuals in Australia have shown that all patients have a KT/V of 1.3 and higher, which shows better results than the present study. This difference could be due to differences in the type of study, differences in sample size, and better services provided in the centers [23]. The different cut-off points used to determine optimal dialysis adequacy in different countries can be an important factor influencing dialysis adequacy, so that in older guides, especially in developing countries, especially in the EMRO, KT/V>1.2 defined as optimal dialysis adequacy but in developed countries KT / V >1.4 to 1.7 are considered as adequate dialysis adequacy [24,25].

The different cut-off points used may be due to differences in the facilities available in dialysis wards in different countries, the number of patients undergoing dialysis, as well as the annual evaluations of dialysis quality in countries. Also, the mean dialysis session length in the present study was 226 minutes. Which was better than North America (223) and worse compared to Turkey (240), Europe (244), and Japan (239) [19]. This could be due to the smaller number of centers and Dialysis beds were available for patients, the number of patients was high and there was a shortage of medical personnel in Middle Eastern countries and the prescribed blood flow rate was 277.9. Which was less than Europe (326), North America (396), and Turkey (349), which could be due to differences in filters used in different dialysis departments and dialysis machines [19]. The mean age of participants in the present study was 49.2 years. However, in previous individual studies in other parts of the world, it was 60.7 and 61.5, which is higher than the present study and indicates the onset of dialysis at a younger age in the Eastern Mediterranean, which may be due to the diagnosis of chronic kidney disease in the late stages [26,27].

Although dialysis adequacy is generally higher than 1.2, due to many differences in social, economic, and health literacy levels of patients in most countries, there is a need to improve infrastructure, increase dialysis centers to better organize the dialysis of patients.

LIMITATIONS :

The most important limitations of the present study were: the most of included studies were cross-sectional so when interpreting the results, specific methodological limitations of this type of study should be considered. Many studies did not provide complete information that contacted the authors. Another limitation was the language of the studies, which included only studies with English abstracts. Another limitation was the high heterogeneity between the studies, which was reduced by categorical analysis

STRENGTHS:

Despite the above limitations, according to the best knowledge of the researchers, this study is the first systematic review study in this field in the region. Also, all indicators related to dialysis adequacy reported in the initial studies were included.

CONCLUSION

This systematic review and meta-analysis study showed that more than half of hemodialysis patients in the EMRO region do not have adequate dialysis adequacy, so it is necessary to review the treatment policies of dialysis centers in different countries, improve the number and quality of equipment in hemodialysis wards. Increasing the knowledge of health workers about the importance and measurement of dialysis adequacy is also essential. The results of the present study can help increase policymakers' awareness of the current state of dialysis adequacy in various countries in the EMRO. Since most studies were single-center, data sharing in the form of a regional registry could provide a better picture of the dialysis adequacy situation in the EMRO.

DISCLOSURE OF POTENTIAL CONFLICTS OF INTEREST

All authors read and approved the final manuscript. All authors of this article have no competing interests to declare.

ETHICS AND DISSEMINATION

Since the data presented here come from published literature and are not associated with patient privacy, ethical approval is not required.

RESEARCH INVOLVING HUMAN PARTICIPANTS AND/OR ANIMALS

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not

contain any studies with human participants or animals performed by any of the authors.

INFORMED CONSENT

N/A

FUNDING

No funding was received to execute this study.

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TABLE 1: SUMMARY OF INCLUDED STUDIES

Author	Year	Country	sampling method	Method to determine the Dialysis adequacy	Design	Participants 1.number of patients 2.age 3.gender(male /female)	Risk of bias	KT/V	Other factors 1.Dialysis Session Length (DSL) (min) (mean) 2. Interdialytic Weight Loss kg m 3.Prescribed Blood Flow Rate n (ml/min)
Aatif, T. [18]	2014	Morocco	convenience	KT/V-URR	Cross-Sectional	1.35 2.46 3.19/16	Moderate	1.82	1.245.17 2.NR 3.291.08
Abbas, H. N. [28]	2009	Pakistan	convenience	URR	Cross-Sectional	1.201 2.51 3.97/104	Moderate		-
Abdelsalam, M. [29]	2019	Egypt	convenience	KT/V	Cross-Sectional	1.193 2.50.9 3.121/72	low	1.35	-
Abdelwhab, S. [30]	2010	Egypt	convenience	KT/V	Cross-Sectional	1.88 2.41.59 3.60/28	low	1.29	-
Adas, H. [31]	2014	Palestine	census	KT/V-URR	Cross-Sectional	1.64 2.58.13 3.41/23	low	1.06	1.238.36 2.NR 3.NR
Afshar, R. [32]	2007	Iran	convenience	URR	Cross-Sectional	1.54 2.44.2 3.35/19	low		-
Aghsaiefard, Z. [33]	2018	Iran	convenience	KT/V	Cross-Sectional	1.176 2.54.14 3.102/74	low	1.23	-
Ahmadi, F. [34]	2017	Iran	convenience	KT/V	RCT	1.54 2.58.2 3.34/20	low	1.3	-

Akhmouch, I. [16]	2011	Morocco	convenience	KT/V	Cross-Sectional	1.47 2.53.4 3.28/19	low		
Al Eissa, M. [35]	2010	Saudi Arabia	convenience	KT/V	Cross-Sectional	1.322 2.51.7 3.200/122	low	1.3	-
Al Saran, K. [17]	2009	Saudi Arabia	convenience	KT/V	Cross-Sectional	1.17 2.47.52 3.9/8	low	1.37	-
Al Saran, K. [36]	2011	Saudi Arabia	census	KT/V-URR	Cross-Sectional	1.146 2.51.21 3.80/66	low	1.45	-
Al-Jahdali, H. H. [37]	2010	Saudi Arabia	census	KT/V	Cross-Sectional	1.188 2.55.7 3.NR	Moderate	-	-
Al-Saedy, A. J.[38]	2011	Iraq	census	KT/V-URR	Cross-Sectional	1.86 2.NR 3.57/29	low	1.02	-
Al-Saran, K. A. [39]	2009	Saudi Arabia	census	KT/V	Cross-Sectional	1.200 2.50 3.108/92	low	1.4	-
Al-Saran, K. A. [40]	2010	Saudi Arabia	census	KT/V	Cross-Sectional	1.23 2.46.83 3.17/6	low	1.19	-
AlYousef, A. [41]	2016	Kuwait	Random	KT/V	Cross-Sectional	1.116 2.55.5 3.62/54	low	1.35	1.219 2.3.24 3.288
AlYousef, A.[41]	2016	Qatar	Random	KT/V	Cross-Sectional	1.58 2.61.6 3.35/23	low	1.51	1.230 2.3.10 3.290
AlYousef, A. [41]	2016	Saudi Arabia	Random	KT/V	Cross-Sectional	1.419 2.50.9 3.230/189	low	1.29	1.202 2.3.54 3.310

AlYousef, A.[41]	2016	UAE	Random	KT/V	Cross-Sectional	1.221 2.54.5 3.134/87	low	1.50	1.226 3.3.32 3.284
Amini, M. [42]	2011	Iran	Random	KT/V-URR	Cross-Sectional	1.4004 2.NR 3.2345/1659	low	1.2	1.229.2 2.NR 3.242.9
Ashrafi, Z [43]	2014	Iran	convenience	KT/V-URR	Cross-Sectional	1.72 2.51.47 3.38/34	low		-
Assal, H. S. [44]	2006	Egypt	convenience	KT/V	Cross-Sectional	1.61 2.40.6 3.33/28	low	1.38	-
Azar, A. T. [45]	2007	Egypt	convenience	KT/V-URR	experimental study	1.134 2.48.21 3.69/65	low	0.99	1.216.6 2.2.048 3.500
Balouchi, A. [46]	2018	Iran	convenience	KT/V	Cross-Sectional	1.144 2.45 3.54/90	low	1.09	-
Bashardoust, Bahman [47]	2007	Iran	convenience	KT/V	Cross-Sectional	1.30 2.54.2 3.17/13	low		-
Beladi Mousavi, Seifollah [48]	2012	Iran	convenience	KT/V-URR	Cross-Sectional	1.54 2.39 3.28/26	low		-
Bradran, A [49]	2006	Iran	convenience	URR	Cross-Sectional	1.36 2.NR 3.21/15	low		-
Dahbour, S. S. [50]	2009	Jordan	convenience	KT/V-URR	Cross-Sectional	1.54 2.NR 3.35/19	low	2.13	-
El Sayed, S. [51]	2009	Saudi Arabia	convenience	KT/V	Cross-Sectional	1.200 2.50 3.108/92	low	1.4	-

Esmaeilivand, M. [52]	2015	Iran	convenience	KT/V-URR	Cross-Sectional	1.152 2.55.77 3.71/81	low	1.24	-
Farhadi,M [53]	2015	Iran	convenience	KT/V-URR	Cross-Sectional	1.44 2.55.80 3.30/14	low	1.08	-
Ghorbane Moghaddam, Zinab [54]	2016	Iran	convenience	KT/V-URR	Cross-Sectional	1.93 2.55.70 3.49/44	low	1.35	-
Haghighi, M. J. [55]	2018	Iran	convenience	KT/V	Cross-Sectional	1.22 2.NR 3.NR	low	0.834	-
Hamid, A. [56]	2019	Pakistan	convenience	URR	Cross-Sectional	1.33 2.51.36 3.13/20	low		-
Hashemi, M [57]	2014	Iran	convenience	KT/V	Cross-Sectional	1.46 2.NR 3.27/19	low		-
Hejaili, F. [58]	2009	Saudi Arabia	convenience	KT/V	Cross-Sectional	1.55 2.55.1 3.31/24	low	1.6	-
Hejaili, F. [59]	2017	Saudi Arabia	convenience	KT/V	Cross-Sectional	1.250 2.53.27 3.132/118	low	2.19	-
Hemayati, R. [60]	2015	Iran	census	KT/V	Cross-Sectional	1.38 2.50.2 3.25/13	low	1.30	-
Hussain, A. [61]	2015	Pakistan	convenience	KT/V	Cross-Sectional	1.90 2.NR 3.50/40	low	1.49	-
Hojjat M [62]	2009	Iran	census	KT/V	Cross-Sectional	1.68 2.58.55 3.44/24	low	0.963	-

Ibrahim, S. [63]	2010	Egypt	convenience	URR	Cross-Sectional	1.100 2.42.67 3.52/48	low		-
Ibrahim, S. [64]	2006	Egypt	convenience	KT/V-URR	Cross-Sectional	1.29 2.45.58 3.19/10	low	1.13	-
Ibrahim, S. [65]	2008	Egypt	convenience	URR	Cross-Sectional	1.60 2.46.13 3.31/29	low		-
Ibrahim, S [66]	2015	Egypt	convenience	URR	Cross-Sectional	1.100 2.50.51 3.38/62	low		-
Jalalzadeh, M [67]	2015	Iran	convenience	KT/V	Cross-Sectional	1.300 2.61.7 3.173/127	low	1.21	-
Kadiri Mel, M. [68]	2011	Morroco	convenience	KT/V	Cross-Sectional	1.37 2.50 3.20/17	low	1.14	-
Kaviannezhad, Rasool [69]	2016	Iran	convenience	KT/V-URR	Cross-Sectional	1.40 2.40.37 3.287/13	low	1.10	-
Lesan Pezeshki, mahboub [70]	2001	Iran	convenience	KT/V	Cross-Sectional	1.37 2.NR 3.22/15	low	1.04	-
Mahdavi-Mazdeh, M. [71]	2007	Iran	convenience	KT/V	Cross-Sectional	1.2630 2.53.4 3.1505/1125	low	0.97	-
Malekmakan, L. [72]	2010	Iran	convenience	KT/V	Cross-Sectional	1.632 2.54.36 3.272/360	low	0.97	-
Malekmakan, L.[73]	2011	Iran	convenience	KT/V	Cross-Sectional	1.73 2.55.4 3.73/0	low	0.9	-

Maoujoud, O. [74]	2012	Morroco	convenience	KT/V	Cross-Sectional	1.48 2.52.3 3.28/20	low	1.22	-
Minoo, F. [75]	2018	Iran	convenience	KT/V	Cross-Sectional	1.135 2.56.45 3.81/54	low	1.2	-
Mogharab, M [76]	2010	Iran	convenience	KT/V-URR	Cross-Sectional	1.50 2.47.80 3.34/16	low	1.17	-
Mohamed, E. I. [77]	2008	Egypt	convenience	KT/V	Cross-Sectional	1.40 2.52.11 3.20/20	low	1.21	-
Moslem, AR. [78]	2008	Iran	convenience	KT/V	Cross-Sectional	1.30 2.52 3.24/6	low	1.39	-
Mozaffari, Naser [79]	2004	Iran	convenience	KT/V	Cross-Sectional	1.70 2.54.3 3.33/37	low	0.68	-
Nadi, Ebrahim [80]	2003	Iran	convenience	KT/V	Cross-Sectional	1.100 2.46 3.NR	low		-
Nasri, H. [81]	2007	Iran	convenience	URR	Cross-Sectional	1.39 2.46 3.15/24	low		-
Nemati, E. [82]	2017	Iran	convenience	KT/V	Cross-Sectional	1.1267 2.54.56 3.695/572	low	0.92	-
Nikparvar, M. [83]	2015	Iran	convenience	KT/V	Cross-Sectional	1.69 2.52.1 3.33/36	low	0.92	-
Oshvandi, KH [84]	2012	Iran	census	KT/V-URR	Cross-Sectional	1.40 2.47.56 3.27/13	low	1.27	-

Ossareh, S. [85]	2016	Iran	census	KT/V	Cross-Sectional	1.560 2.54.8 3.323/237	low	1.3	-
Pakpour, A. H. [86]	2010	Iran	convenience	KT/V	Cross-Sectional	1.250 2.52.63 3.140/110	low		-
Pourfarziani, V. [87]	2008	Iran	convenience	KT/V-URR	Cross-Sectional	1.338 2.NR 3.171/167	low	1.17	-