

Original Research

Evaluation of Medication Adherence and Depression Prevalence Among Hemodialysis Patients in Iraq

Hany A. Al-Hussaniy , Ali Yousif Nori, Hanan Jadaan Ali , Mahmood Al-Ibadah, Amjad I Oraibi , Ali Mahmoud Al-Samydai , Ali Abo-ragheef

Received (first version): 22-Mar-2024

Accepted: 02-May-2024

Published online: 18-Feb-2025

Abstract

Background: End-stage kidney disease requires renal replacement therapy (RRT) because of a gradual decline in kidney function. Hemodialysis is the most commonly used renal replacement therapy worldwide, and frequently leads to neuropsychiatric issues, with depression being the most prominent. Nonadherence to drug therapy is considered one of the most significant drug-related issues among hemodialysis patients, and various studies have shown that nonadherence is common. This study aimed to determine the prevalence of depression and non-adherence to drug therapy, and to identify predictors of depression and non-adherence among hemodialysis patients. **Subjects and Methods:** This cross-sectional study included 99 patients and 33 healthy controls. The data collected encompassed personal and disease-related variables. The data collected included personal and disease-related variables from AL-Yarmouk Hospital during the period from 20th July to 20 August 2019. Adherence to medication was assessed using a validated medication adherence scale and participants' depression levels were evaluated using a standardized depression questionnaire. **Results:** The median age of the patients was 51.2 ± 14.4 years, with the majority being male (67.7%). Depression was prevalent in 86.9% of the patients, which was significantly higher than the prevalence in the control group (63.6%). The sick group's median depression score was noticeably greater than the control groups. There were no discernible differences between patients with and without depression in terms of sociodemographic characteristics or illness indicators. Non-adherence was common, with 47.47% of the patients being non-adherent. **Conclusions:** Depression is prevalent among hemodialysis patients and is unrelated to any personal or medical features.

Keywords: glomerular filtration rate; medication adherence; patient compliance; renal dialysis

BACKGROUND

Chronic kidney disease (CKD) a disease in patients who experience renal dysfunction after 100 days, which is typically caused by a chronic disease state such as metabolic dysregulation (diabetes mellitus, for example), genetic factors (Alport syndrome, for example), or dysfunction of the renal structure as a result of kidney stones or reduced blood flow to the nephrons. These disorders have the potential to progress to CKD, a stage of renal failure, if they are not addressed.¹ The rate of glomerular filtration is denoted by the letter "G" in the

hierarchy of chronic kidney disease (CKD) stages, which range from G1 to G5. G5 is the most severe stage of CKD, which can lead to end-stage renal disease, while G1 denotes moderate CKD.

End-stage renal disease (ESRD) is the final stage of CKD, characterized by a significantly reduced glomerular filtration rate (GFR), leading to a decrease in urine output to a level lower than 0.4 liters per day (oliguria) or even lower (anuria). This reduction in urine output can cause accumulation of toxins, metabolic products, fluids, and electrolytes, which are normally eliminated by the kidneys. In ESRD, renal replacement therapy is typically necessary to replace the lost kidney function.² End-stage renal disease is a final state of massive damage to kidney function, which results in kidney failure in general and a decrease in the rate of renal filtration, which leads to a decrease in ultrafiltrate volume and, which negatively affects the decrease in the rate of toxins that are excreted from the body. If the level of To a rate of less than 0.4 liters per day, which may be lower than that of what is called oliguria or anuria, respectively. This decrease in the rate of perception leads to the accumulation of large quantities of Urea, ammonia, toxins, nitrogenous wastes, liquids and other substances, the rise of which leads to serious damage to the human body, which are filtered and disposed of naturally every day outside the human body.

In the event that the patient reaches this degree of illness, it is recommended that he undergo a kidney transfer (transplant) and hemodialysis in order to complete this procedure.³

Hany A. AL-HUSSANIY*. Department of Pharmacy, Al-Nisour University College, Baghdad, Iraq

Ali Yousif NORI. Department of Pharmacy, AL Mustafa University College, Baghdad, Iraq

Hanan Jadaan ALI. PhD Pharmacology, Department of Pharmacy, Al-Hadbaa University college, Mosul, Iraq

Mahmood AL-IBADAH. Department of Medical Laboratory Techniques, College of Medical Technology, Al-Farahidi University, Baghdad, Iraq.

Amjad I ORAIBI. Department of Pharmacy, Al-Manara College for Medical Sciences, Amarah, Iraq.

Ali Mahmoud AL-SAMYDAI. Pharmacological and Diagnostic Research Center, Faculty of Pharmacy, Al-Ahliyya Amman University, Amman, 19328, Jordan.

Ali ABO-RAGHEEF*. Ashford & St Peter's Hospitals NHS Trust, Surrey, UK.



The ESRD is one of most common health issue in the world, Statistics from 2009 show that the Middle East has over 100,000 individuals with end-stage renal disease (ESRD), with a mean prevalence of 430 per million people (pmp). Lebanon has the highest incidence of 818 pmp, whereas Iraq has the lowest incidence of 55 pmp.⁴ A study conducted in 2011 reported that the total prevalence of patients undergoing public hemodialysis programs in Baghdad was 64 pmp, which was lower than that in other countries, such as Iran (178 pmp). Moreover, the number of private hemodialysis (HD) facilities in Baghdad is very limited.⁵ There are over 20 hemodialysis clinics in Iraq, each with an average of 10 service beds. Six dialysis facilities are located in Baghdad, the capital city of Iraq. In 2010, Saudi Arabia had 176 dialysis facilities.^{6,7}

Patients with end-stage kidney disease (ESKD) require renal replacement therapy (RRT). Dialysis, including hemodialysis (HD), peritoneal dialysis (PD), and kidney transplantation, is used for RRT.⁸ The dialysis process is described as the diffusion of molecules in solution along an electrochemical concentration gradient over a semipermeable membrane.^{9,10} HD and PD are the two main types of dialysis treatment. Both HD and PD have been developed to remove metabolic waste products from semi-permeable membranes.¹¹ To enhance the quality of life and reduce the morbidity and mortality associated with ESKD, dialysis aims to eliminate toxic metabolites to reduce uremic symptoms, correct electrolyte imbalances, restore acid-base status, and preserve volume status.¹²

Hemodialysis is costly, time-consuming, and requires hydration and food restriction. Long-term dialysis therapy alone frequently causes a loss of independence; reliance on caretakers; disturbance of marital, familial, and social life; and decreased or lost financial resources.¹⁰ Hemodialysis is often recommended three times a week for three–five hours. The number of hours of HD hinders professional and social functioning and contributes to the deterioration of quality of life.¹¹

The World Health Organization (WHO) states that ‘the degree to which a person’s conduct corresponds to the instructions agreed upon with a medical practitioner in terms of taking medicine, following the suggested diet, and making adjustments in lifestyle’ is what is meant by sticking to treatment.¹² Adherence and compliance were used interchangeably. However, this also has distinct implications.^{4,13}

It is possible for non-adherence to medicine to be both intentional and involuntary. Intentional nonadherence was defined as the choice made by patients to defy treatment guidelines by skipping, modifying, or delaying the recommended dosage of prescription drugs. On the other hand, inadvertent non-compliance arises from a patient’s inadequate understanding, forgetfulness, or inappropriate correspondence with healthcare providers.^{14,15}

Medication nonadherence in chronic patients, including those receiving HD, has been associated with several factors. These components were categorized by Jin et al.¹⁶ into the following categories: therapy-related, social and economic, patient-

centered, healthcare system-related, and disease-related.

Causes of non-adherence

Both deliberate and involuntary non-adherence to medication are possible. Patients who opted to disobey treatment recommendations by postponing, changing, or skipping the dosage of prescribed medications were said to have engaged in intentional nonadherence. In contrast, unintentional non-adherence results from a patient’s lack of comprehension, forgetfulness, or improper communication with medical professionals.^{14,15}

In chronic patients, such as those undergoing HD, nonadherence to medication has been linked to a number of variables. Jin et al. divided these elements into categories such as patient-centered, therapy-related, social and economic, healthcare system-related, and disease-related.¹⁶

Enhancing adherence in hemodialysis patients

To design sensible measures to increase treatment adherence, it is crucial to understand the factors that influence CKD patients’ decisions to stop taking their treatments at any moment.¹⁷

Direct and indirect measurement methods can be used to categorize the available adherence measurement techniques. Every technique has its benefits and drawbacks, and none are considered the best.¹⁸⁻²⁰ One of the crucial indirect techniques for monitoring medication adherence is patient self-reporting or questionnaires, which are frequently utilized in clinical settings. Various other relevant free adherence scales are available that can be used as alternatives to the Morisky Medication Adherence Scale (MMAS-8), which is a Simplified Medication Adherence Questionnaire. These scales may offer different approaches for assessing medication adherence, and can be valuable in different clinical contexts and patient populations. Researchers and healthcare professionals can explore and choose the most suitable adherence scale based on their specific requirements and the characteristics of the target population.^{21,30}

Depression

Depression is another illness with a significant incidence worldwide. At any given time, depression affects more than 340 million individuals worldwide. This is a prevalent condition similar to hypertension.²¹ Depression is the fourth leading cause of illness worldwide, according to the World Health Organization (WHO), and the leading cause of disability (based on years lived with disability).²² It may be challenging to assess depression that occurs alongside other medical conditions. Depressive symptomatology may reflect the emotional strain of managing the illness, may result from the disease process or from drugs used to treat it, or may coexist over time with the medical diagnosis.²³ In people with chronic medical conditions, depression is frequently ignored and undertreated, which frequently has detrimental effects.²³

Depression among hemodialysis patients

Dialysis is a demanding procedure (for most CKD patients) that is followed by a number of psychological and social issues that



might cause patients to experience mental disorders.²⁴ When dialysis is initiated, patients with CKD experience minor changes in their lives, mostly in the physical and social world. Therefore, patients with CKD frequently experience neuropsychiatric adverse effects. Given its high frequency, detrimental effects on quality of life, and propensity to increase mortality, depression is the most significant.²⁵ In individuals with ESKD, depression can develop as a result of losing a primary position in their job or family, deterioration in physical function, decline in cognitive abilities, or drop in sexual function.²⁵ According to reports, people with ESKD sense a loss of autonomy and lack of understanding from their families, doctors, and society, which can make them feel even more hopeless.²⁵ Even in the early phases of predialysis, patients with CKD had higher rates of depression than those in the general population and those with other chronic illnesses.²⁶

Consequence of depression in hemodialysis patients

Compared to individuals without depressive symptoms, patients with CKD who were depressed and receiving hemodialysis had a greater risk of mortality and hospitalization. Through a variety of pathways, depression has the potential to negatively impact the medical outcomes of people with ESKD.²⁶ Psychological pressures may make it harder for patients to follow their drug schedules, and poor compliance in dialysis patients has been linked to higher depressive affect in prior research. Additionally, depression has been linked to altered immune system performance, particularly, reduced cellular immunity and elevated cytokine levels. Additionally, depression has been demonstrated to occur before a drop in blood albumin levels in individuals with ESKD and is associated with poor nutritional status.²⁷ Studies have shown that suicidal thoughts or attempts are substantially more frequent among dialysis patients than among the general population, and depression is also associated with low quality of life.²⁷

Several techniques have been used to assess depressive symptoms in patients.²⁸ It is uncertain which screening tool and diagnostic technique are the best for detecting depression and depressive symptoms in patients with renal illness. The PHQ-9, a nine-question questionnaire, is an easy-to-use depression-screening tool. It consists of nine questions, each of which measures the severity of depression on a scale from 0 to 3. Increased depressive affect correlated with higher PHQ-9 scores. The PHQ-9 can yield a maximum score of 27.²⁹

OBJECTIVES

This study aimed to find out the prevalence of depression in patient who on hemodialysis, as well as the factors that predict depression and medication non-adherence.

METHODS

Study Design and Setting:

This cross-sectional study was conducted at The Iraqi Center of Renal Dialysis (Medical City/Baghdad) and The Center of Kidney Disease and Kidney Transplantation (Al-Yarmook

Teaching Hospital/Baghdad) during the period from 20th July to 20th August.2019.

Study Participants and Sampling:

The study comprised 99 patients with end-stage kidney disease (ESKD) who visited the aforementioned clinics, including 67 male and 22 female patients, and 33 control participants (22 male and 11 female) who appeared to be in good condition. The following patients met the inclusion criteria: hemodialysis patients who had been undergoing regular hemodialysis twice a week or more for at least six months, and ESKD patients who were 18 years of age or older, regardless of gender.

Data Collection Tool and Technique:

Adherence Level: The researcher personally interviewed the patients using the Simplified Medication Adherence Questionnaire in Arabic.^{30,31} The Simplified Medication Adherence Questionnaire consists of eight items, including seven yes-or-no questions and one multiple-choice question with five options. Each question was assigned a score and the final score was calculated by adding the scores of all eight questions. Adherence levels were categorized as low (score 0-5), medium (score 6-7), or high (score 8) based on the total score.

Depression Level: The Patient Health Questionnaire-9 (PHQ-9) was used to assess depressive symptoms. The PHQ-9 is a 9-item questionnaire, and each item is scored from 0 to 3. Total scores were used to provide a provisional diagnosis of depression, categorized as no depression (0-4), mild depression (5-9), moderate depression (10-14), moderate-severe depression (15-19), and severe depression (20-27).

Statistical Analysis:

The Anderson-Darling test was used to assess the normal distribution of continuous data. For normally distributed data, median and interquartile range (IQR) are presented. The chi-square test and Fisher's exact test were used to analyze the significance of the discrete variables. The t-test and Mann-Whitney U test were used to compare means and medians, respectively, between two samples based on the nature of the data. Univariate analysis using binary logistic regression was performed to identify the predictors of depression or adherence. A multivariate analysis was conducted using the backward elimination method to select the best predictors. The level of significance was set at $P < 0.05$. Statistical analyses were performed using IBM SPSS version 21 and Minitab Vision 17.

RESULT

Sociodemographic data

A total of 132 participants were included in this research :99 patients undergoing hemodialysis and 33 healthy controls. The median age of the patients was 51.2 ± 14.4 years and that of the control group was 49.39 ± 6.05 years. Most participants were male (67.7% of patients and 66.7% of the control group). In total, 71.7% of the patients and 81.8% of the control group



were married. A total of 21.2% of patients and 84.8% of the control group had a college education. In total, 87.9% of the patients and 100% of the control group were urban residences. Both age and sex showed no significant differences between them, and marital status did not show a significant difference. However, both educational level (college) and residence (urban) were significantly lower in the patients, as illustrated in table 1.

Table 1: Sociodemographic data of participants			
	Control	Patients	P value
Number	33	99	-
Age	49.39 ± 6.05	51.2 ± 14.4	0.315 ^a
Gender (male)	22 (66.7%)	67 (67.7%)	0.915 ^b
Marital status (married)	27 (81.8%)	71 (71.7%)	0.25 ^b
Educational level (college)	28 (84.8%)	21 (21.2%)	<0.001 ^b
Residence (urban)	33 (100%)	87 (87.9%)	0.036 ^b

a T test, b chi square test

Depression

Distribution of patients and control group by having depression

Overall, 86.9% of the patients had depression (any level), which was significantly higher than that of the control (30.3%) (table 2).

Distribution of patients and control group by levels of depression

The distribution of depression by severity level was significantly different between patients and controls, with nearly all levels

Table 2: Distribution of patients and control group by having depression					
Depression		Control	Patients	Total	P value
No depression	No.	12	13	25	0.003
	%	36.4%	13.1%	18.9%	
depression	No.	21	86	107	
	%	63.6%	86.9%	81.1%	
Total		33	99	132	

Chi square test

of depression being higher in the patients than in the control group (table1, figure 1).

In addition, the overall depression levels of moderate, moderate to severe, and severe depression) was significantly higher in patients (51.5%) than in controls (30.3%), as illustrated in (figure 2).

Disease characteristics of patients divided by depression

None of the disease characteristics of patients showed significant differences between patients with and without depression.³² however, the presence of co morbidities and more than five medications was higher in patients with depression (figure 3).

Risk factors for depression among hemodialysis patients

Unadjusted (univariate) analysis.

Age > 50 years, residence in the urbane, presence of co-morbidities, and increased number of medications predicted depression; however, these predictors were weak (odds ratio was not significant), as illustrated in table 3.

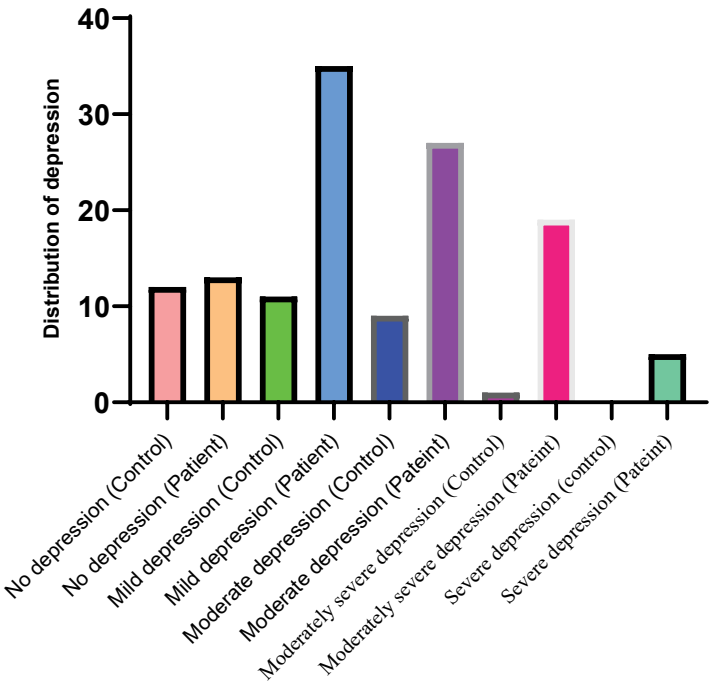


Figure 1. Levels of depression in patients and control group



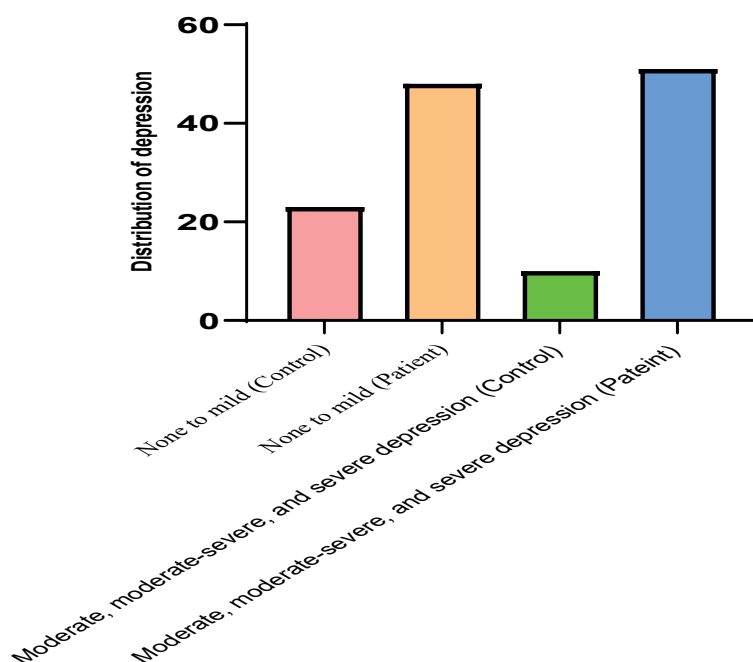


Figure 2. Distribution of depression by (none to mild) versus (Moderate, moderate-severe, and severe depression

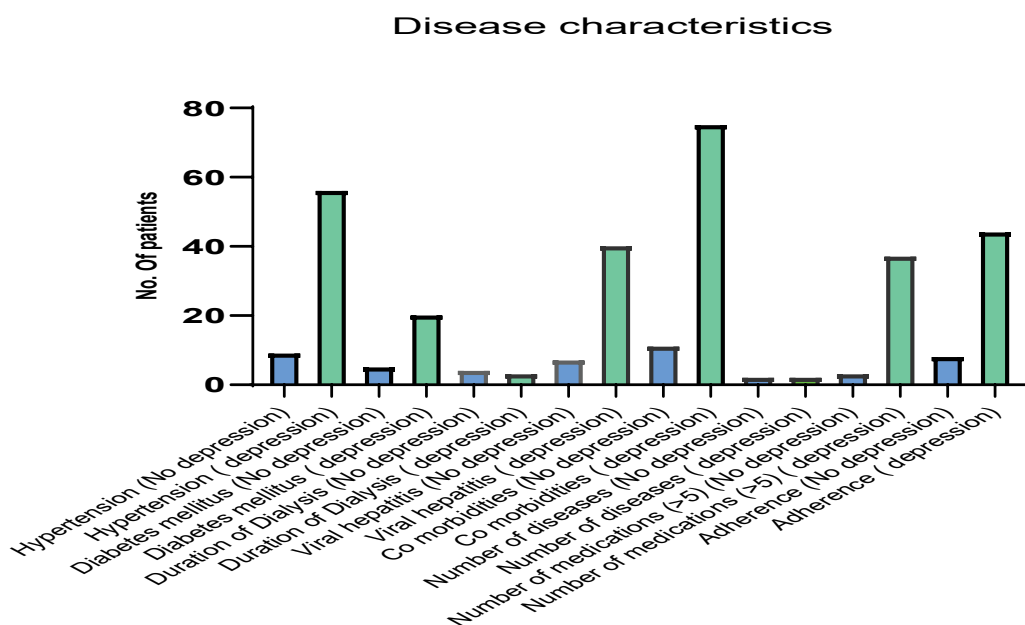


Figure 3. Disease characteristics of the patients divided by presence of depression

Variables	OR	95%CI	P value
Age (≥50 years)	1.446	0.447 – 4.683	0.538
Gender (male)	0.339	0.071 – 1.632	0.177
Marital status (marriage)	0.42	0.087 – 2.028	0.28
Educational level (college)	0.554	0.152 – 2.018	0.371
Residence (urban)	2.567	0.594 – 11.089	0.207
Duration of dialysis	0.89	0.689 – 1.15	0.374
Diabetes mellitus	0.485	0.143 – 1.649	0.246
Hypertension	0.83	0.236 – 2.92	0.771
Viral hepatitis (B &/or C)	0.745	0.231 – 2.401	0.622
Co-morbidities (any)	1.24	0.242 – 6.353	0.797
Number of diseases	0.793	0.421 – 1.494	0.473
Number of medication	2.517	0.647 – 9.797	0.183
Adherent	0.655	0.198 – 2.162	0.487

Univariate binary logistic regression analysis. OR: odd ratio, 95%CI: 95 percent confidence interval.

Adherence

Regarding the degree of adherence, the present study revealed that, as shown in figure 4, 52 patients (52.53%) had high adherence levels (and were therefore considered adherent), while 23 patients (23.23%) had medium adherence levels, and 24 patients (24.24%) had low adherence levels (and were therefore considered non adherent).³³

	Non adherent	Adherent	P value
Number	47	52	-
Patient age	46.0 ± 12.8	55.9 ± 14.3	0.001 ^a
Male	32 (68.1%)	35 (67.3%)	0.934 ^b
married	31 (66%)	40 (76.9%)	0.226 ^b
Complete college degree	5 (10.6%)	16 (30.8%)	<0.014 ^b
Residence (urban)	39 (83%)	4 (7.7%)	0.156 ^b

^aT test, ^bchi square test

Adherence among patients was used to divide sociodemographic characteristics.

As shown in table 4, the adherent group had a significantly larger proportion of older people and college graduates ($p = 0.05$), whereas the adherent and non-adherent groups did not differ substantially in terms of sex, marital status, or place of residence.

Patient disease features broken down by adherence

Figure 5 shows that the remaining illness features were not substantially different between adherent and non-adherent groups. However, hypertension and the number of drugs were considerably greater in adherent patients (p -value 0.05).

Distribution of patients by their adherence level

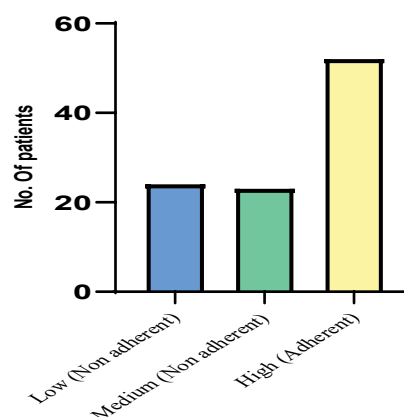


Figure 4. Distribution of patients by their adherence level

DISCUSSION

Hemodialysis is the most widely used renal replacement therapy; however, patient survival and quality of life during HD remain major concerns.^{34,35} Patients with end-stage kidney disease have social and psychological issues because they alter their way of life and receive treatment.³⁶ Affective disorders, particularly depression, are the most common and severe psychopathological effects of ESKD.³⁶ The demographic characteristics of the recruited patients were similar to those of comparable individuals documented in previous studies. In this study, men made up the majority (67.7%), which is similar to the finding (66.67%) reported by Zainab et al. for the Thi-qar Governorate in Iraq.³⁷ According to a meta-analysis of 68 studies with 11,345 individuals, males with chronic renal disease of various etiologies showed a faster decline in renal function over time than women.³⁸ The median age of patients was (51.2 ± 14.4 years) which is comparable to that reported by Mizher *et al.* among HD patients in Al Amarah City/ Iraq where the majority of the study sample was between (48 and 57 years old).³⁹⁻⁴¹

In this study, a high percentage of HD patients reported having depressive symptoms (86.9%), which is comparable to the (80.0%) reported by Atia et al. among HD patients recruited from two HD centers in Baghdad/Iraq.⁴² A patient's degree of physical, emotional, social, and financial stress may considerably increase when they require continued hemodialysis therapy, which increases the risk of continuous hemodialysis therapy. This can significantly increase a patient's level of physical, mental, social, and financial stress, which increases the risk of depression in this group of patients. On the other hand, if the patient is the family's sole provider, the stress of losing their job, escalating financial issues, relying on other family members for care, and routine household expenses might exacerbate their melancholy.⁴³ The control group showed a significant prevalence of depression (63.6%); however, more than half of the cases were mild. The Iraq and Iraqi people experienced conflict, sanctions, and brutality in the past. Research has demonstrated that exposure to violence is

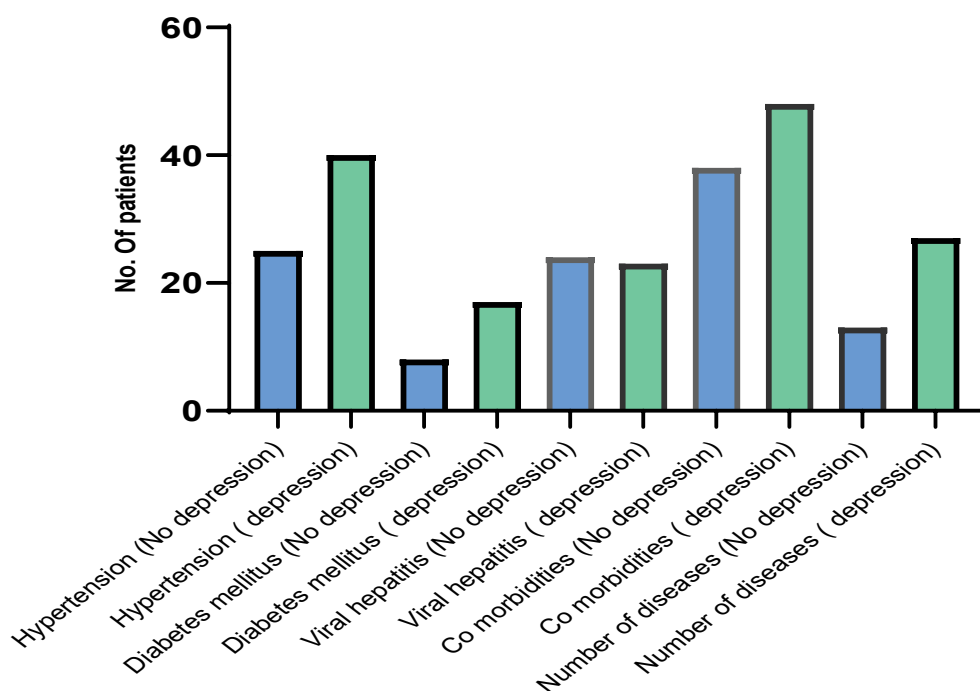


Figure 5. Disease characters of the patients divided by adherence

linked to a number of mental disorders, including depression.⁴⁴

None of the sociodemographic parameters of patients did not showed significant differences between patients with and without depression. Raheem *et al.*, in their study of HD patients recruited from two HD centers in Baghdad/Iraq, found that factors with statistically significant associations with depression included female sex and being married (contrary to the current finding), while factors not associated with depression included level of education and residence (consistent with the current finding).⁴⁵

Poor long-term adherence and persistence to pharmacological therapy can lead to significant worsening of the disease, increased mortality, and higher healthcare expenses. Clinical investigations have shown that patients undergoing therapy for chronic diseases adhere to their regimens on average only between 43% and 78% of the time.^{46,47} In the current study, 52.53% of the patients were adherent (with a high adherence level), whereas 47.47% were non-adherent (with low to medium adherence levels). The prevalence of adherent patients reported in the current study was higher than that reported by Abdulmalik *et al.* (28.09%) among HD patients in King Abdul Aziz Medical City using the Simplified Medication Adherence Questionnaire.⁴⁸

Regarding the association between sociodemographic characteristics of patients and adherence, the mean age and college education were significantly higher in the adherent group, whereas sex, marital status, and residence did not show significant differences between the adherent and non-adherent groups. Various demographic characteristics were substantially

related to non-adherence. One of the most frequently reported variables was age, and younger age was frequently linked to nonadherence.⁴⁹ which was consistent with the findings of the current study. In line with the current study, Yoke *et al.* found that younger HD patients were more non-compliant with the therapeutic regimen than their older counterparts.^{50,51} In the current study, college education, hypertension, and an increased number of medications were significant predictors of adherence, whereas the rest were weak predictors. Schmid *et al.* concluded that higher adherence was associated with a higher level of education among patients undergoing HD.^{19,52} A highly educated patient might understand the usefulness of the treatment more easily, which contributes to better adherence.⁵³⁻⁵⁶ The finding that having an increased number of medications was a significant predictor of adherence may be related to their higher educational level since all three predictors were dependent predictors.

CONCLUSION

We may conclude that depression is a frequent health issue among hemodialysis patients in this study, with no correlation between the incidence of depression and either personal characteristics or illness features that must be based on health policies. A significant percentage of hemodialysis patients at these two facilities were found to be non-adherent to medication.

ACKNOWLEDGMENT

ETHICAL STATEMENT: This research involved human volunteers



under ethical standards and the 1964 Declaration of Helsinki. All work protocols were registered, and get ethical approval number 2849 was obtained in 2020.

CONFLICT OF INTEREST

None

FUNDING

None

DATA AVAILABILITY

The questioner forums available in zenodo DOI: 10.5281/zenodo.8311448

References

1. Cohen EP, Hankey KG, Farese AM, Parker GA, Jones JW, Kane MA, et al. Radiation Nephropathy in a Nonhuman Primate Model of Partial-body Irradiation with Minimal Bone Marrow Sparing-Part 1: Acute and Chronic Kidney Injury and the Influence of Neupogen. *Health Phys.* 2019;116(3):401-8. <https://doi.org/10.1097/hp.0000000000000960>
2. Huebinger RM, Walia S, Yealy DM, Kellum JA, Huang DT, Wang HE. Outcomes of end-stage renal disease patients in the PROCESS trial. *Journal of the American College of Emergency Physicians Open.* 2021;2(1):e12358. <https://doi.org/10.1002/emp2.12358>
3. Xie Y, Bowe B, Mokdad AH, Xian H, Yan Y, Li T, et al. Analysis of the Global Burden of Disease study highlights the global, regional, and national trends of chronic kidney disease epidemiology from 1990 to 2016. *Kidney international.* 2018 ;94(3):567-81. <https://doi.org/10.1016/j.kint.2018.04.011>
4. Beshna E, Alwafi SA, Lazrak RR. Evaluation of the Quality of life of Zawia (Libya) patients undergoing hemodialysis. *Medical and Pharmaceutical Journal.* 2023 ;2(1):4-16. <https://doi.org/10.55940/medphar202229>
5. Humudat YR, Al-Naseri SK. Heavy metals in dialysis fluid and blood samples from hemodialysis patients in dialysis centers in baghdad, iraq. *Journal of Health and Pollution.* 2020;10(27):200901. <https://doi.org/10.5696/2156-9614-10.27.200901>
6. Al Attar B. Renal replacement therapy in the Kingdom of Saudi Arabia. *Saudi Journal of Kidney Diseases and Transplantation.* 2020;31(6):1458-69. <https://doi.org/10.4103/1319-2442.308375>
7. Shahbaz M. Data from a large hemodialysis center form an industrial city: Demographics, etiology and hepatitis status. *Pakistan Journal of Kidney Diseases.* 2019;3(10).
8. Wilkie M, Davies S. Peritoneal dialysis in the time of COVID-19. *Peritoneal Dialysis International.* 2020;40(4):357-8. <https://doi.org/10.1177/0896860820921657>
9. Abdulameer AA, Mohammed ZN, Tawfeeq KT. Endoscopic characteristics and management of Subepithelial Lesions in Video-Gastrosocpie. *Med Pharm J.* 2022;1(1):4-13. <https://doi.org/10.55940/medphar20221>
10. Ellis P. An overview of haemodialysis. *British Journal of Nursing.* 2023;32(8):356-60.
11. Ito Y, Ryuzaki M, Sugiyama H, Tomo T, Yamashita AC, Ishikawa Y, et al. Peritoneal dialysis guidelines 2019 part 1 (position paper of the Japanese Society for Dialysis Therapy). *Renal Replacement Therapy.* 2021;7(1):40. <https://doi.org/10.1186/s41100-021-00348-6>
12. Pei M, Aguiar R, Pagels AA, Heimbürger O, Stenvinkel P, Bárány P, et al. Health-related quality of life as predictor of mortality in end-stage renal disease patients: an observational study. *BMC nephrology.* 2019;20(1):1-0. <https://doi.org/10.1186/s12882-019-1318-x>
13. Naji MA, Alburghaif AH, Saleh NK, Al-hussaniy H. Patient expectations regarding consultation with a family doctor: a cross-sectional study. *Medical and Pharmaceutical Journal.* 2022;1(1):35-40. <https://doi.org/10.55940/medphar2022-3>
14. Rabindranath KS, Nessim SJ, Bargman JM. Small Solute Clearance in Peritoneal Dialysis. *Evidence-Based Nephrology.* 2022;2:91-112.
15. Hussein ZR, Omar SK, Mustafa Alkazraji RA, Alsamarrai AN, Alrubaye HS, Al-Hussaniy HA. Efficacy of Aflibercept as initial treatment for neovascular age-related macular degeneration in an Iraqi patient sample. *Journal of Medicine & Life.* 2023;16(2). <https://doi.org/10.25122/jml-2022-0356>
16. Jin H, Fang W, Zhu M, Yu Z, Fang Y, Yan H, et al. Urgent-start peritoneal dialysis and hemodialysis in ESRD patients: complications and outcomes. *PLoS One.* 2016;11(11):e0166181. <https://doi.org/10.1371/journal.pone.0166181>
17. Li WW, Kuo CT, Hwang SL, Hsu HT. Factors related to medication non-adherence for patients with hypertension in Taiwan. *Journal of clinical nursing.* 2012;21(13-14):1816-24. <https://doi.org/10.1111/j.1365-2702.2012.04088.x>
18. John JC, Taha S, Bunchman TE. Basics of continuous renal replacement therapy in pediatrics. *Kidney research and clinical practice.* 2019;38(4):455. <https://doi.org/10.23876%2Fj.krcp.19.060>
19. Ricci Z, Ronco C. Timing, dose and mode of dialysis in acute kidney injury. *Current opinion in critical care.* 2011;17(6):556-61. <https://doi.org/10.1097/MCC.0b013e32834cd360>
20. Schmid H, Hartmann B, Schiffli H. Adherence to prescribed oral medication in adult patients undergoing chronic hemodialysis: a critical review of the literature. *European journal of medical research.* 2009;14(5):185-90. <https://doi.org/10.1186/2047-783X-14-5-185>
21. Tan XI, Patel I, Chang J. Review of the four item Morisky medication adherence scale (MMAS-4) and eight item Morisky



- medication adherence scale (MMAS-8). *INNOVATIONS in pharmacy*. 2014;5(3):5. <https://doi.org/10.1111/ijcp.14717>
22. Dinas PC, Koutedakis Y, Flouris AD. Effects of exercise and physical activity on depression. *Irish journal of medical science*. 2011;180:319-25. <https://doi.org/10.1007/s11845-010-0633-9>
 23. Hossain HU, Aftab A, Soron TR, Alam MT, Chowdhury MW, Uddin A. Suicide and depression in the World Health Organization South-East Asia region: A systematic review. *WHO South-East Asia journal of public health*. 2017;6(1):60-6. <https://doi.org/10.4103/2224-3151.206167>
 24. Salim Mahmood A, Ammoo AM, Ali MH, Hameed TM, Al-Hussaniy HA, Aljumaili AA, et al. Antiepileptic Effect of Neuroaid® on Strychnine-Induced Convulsions in Mice. *Pharmaceuticals*. 2022;15(12):1468. <https://doi.org/10.3390/ph15121468>
 25. Lopes AA, Bragg J, Young E, Goodkin D, Mapes D, Combe C, Piera L, Held P, Gillespie B, Port FK. Depression as a predictor of mortality and hospitalization among hemodialysis patients in the United States and Europe. *Kidney international*. 2002;62(1):199-207. <https://doi.org/j.1523-1755.2002.00411.x>
 26. Eltayeb M, Khalil A, Sany D. Prevalence of depression among hemodialysis patients. *Hemodial Int*. 2010;14:114. <https://doi.org/10.1590/1516-4446-2018-0345>
 27. Khan A, Khan AH, Adnan AS, Sulaiman SA, Mushtaq S. Prevalence and predictors of depression among hemodialysis patients: a prospective follow-up study. *BMC public health*. 2019;19(1):1-3. <https://doi.org/10.1186/s12889-019-6796-z>
 28. Cohen SD, Sharma T, Acquaviva K, Peterson RA, Patel SS, Kimmel PL. Social support and chronic kidney disease: an update. *Advances in chronic kidney disease*. 2007;14(4):335-44. <https://doi.org/10.1053/j.ackd.2007.04.007>
 29. de Alencar SB, de Lima FM, Dias LD, Dias VD, Lessa AC, Bezerra JM, et al. Depression and quality of life in older adults on hemodialysis. *Brazilian Journal of Psychiatry*. 2019;42:195-200. <https://doi.org/10.1590/1516-4446-2018-0345>
 30. Levis B, Sun Y, He C, Wu Y, Krishnan A, Bhandari PM, et al. Accuracy of the PHQ-2 alone and in combination with the PHQ-9 for screening to detect major depression: systematic review and meta-analysis. *Jama*. 2020;323(22):2290-300. <https://doi.org/10.1001/jama.2020.6504>
 31. Saeed N. Translation and Validation of a Simplified Medication Adherence Questionnaire and Factors Affecting Chronic Diseases Medication Adherence among Arab Americans (Doctoral dissertation, Howard University).
 32. Altaiebi RR, Al-Hussaniy HA, Al-Tameemi ZS, Al-Zobaidy MA, Albu-Rghaif AH, Alkuraishy HM, et al. Non-alcoholic fatty liver disease: relation to juvenile obesity, lipid profile, and hepatic enzymes. *Journal of Medicine & Life*. 2023;16(1):42-7. <https://doi.org/10.25122/jml-2022-0091>
 33. Al-Hussaniy HA, Mohammed ZN, Alburghaif AH, Naji MA. Panax ginseng as Antioxidant and Anti-inflammatory to reduce the Cardiotoxicity of Doxorubicin on rat module. *Research Journal of Pharmacy and Technology*. 2022;15(10):4594-600.
 34. Hadi HM, Shahada AR, Hussein NM, Hussein EHA. Doxorubicin Side Effects and Its Uses a new update: A narrative review. *Arabian J. Drug Res*. 2021;1(1):1-6. Available from: <https://pharmacoj.com/ojs/index.php/AJDR/article/view/64>
 35. Awad M, Al-Hussaniy HA, Alburghaif AH, Tawfeeq KT. The role of COVID-19 in myopathy: incidence, causes, treatment, and prevention. *Journal of Medicine and Life*. 2022;15(12):1458. <https://doi.org/10.25122/jml-2022-0167>
 36. Maruyama Y, Higuchi C, Io H, Wakabayashi K, Tsujimoto H, Tsujimoto et, al. Comparison of peritoneal dialysis and hemodialysis as first renal replacement therapy in patients with end-stage renal disease and diabetes: a systematic review. *Renal Replacement Therapy*. 2019;5(1):1-2.
 37. Bruce MA, Beech BM, Sims M, Brown TN, Wyatt SB, Taylor HA, et al. Social environmental stressors, psychological factors, and kidney disease. *Journal of Investigative Medicine*. 2009;57(4):583-9. <https://doi.org/10.2310/jim.0b013e31819dbb91>
 38. Kadhem ZA. Blood calcium balance and dialysate calcium concentration in hemodialysis patients in Thi-Qar Province, Iraq. *University of Thi-Qar Journal Of Medicine*. 2014;8(1):39-49.
 39. Neugarten J, Acharya A, Silbiger SR. Effect of gender on the progression of nondiabetic renal disease: a meta-analysis. *Journal of the American Society of Nephrology*. 2000;11(2):319-29. <https://doi.org/10.1681/asn.v112319>
 40. Al-Rishawi M, Al-Juboori AK. Anxiety and Depression Symptoms of Renal Failure Patients undergoing Hemodialysis at Al Saddar Teaching Hospital in Al Amarah City. *Kufa J. for Nurs. Sciences*. 2015;5(2).
 41. Al_hussaniy HA. Medical Scientific Research Challenges in Iraq. *Medical and Pharmaceutical Journal*. 2023;2(1):1-3.
 42. Hommel K, Rasmussen S, Kamper AL, Madsen M. Regional and social inequalities in chronic renal replacement therapy in Denmark. *Nephrology Dialysis Transplantation*. 2010;25(8):2624-32. <https://doi.org/10.1093/ndt/gfq110>
 43. Atia H, Yasir A, Khuder K. Assessment of Depression for Adult Patients with Hemodialysis. *Medical Journal of Babylon*. 2012;9(1):60-9.
 44. Jungers P, Chauveau P, Descamps-Latscha B, Labrunie M, Giraud E, et al. Age and gender-related incidence of chronic renal failure in a French urban area: a prospective epidemiologic study. *Nephrology Dialysis Transplantation*. 1996;11(8):1542-6.
 45. Muehrer RJ, Schatell D, Witten B, Gangnon R, Becker BN, Hofmann RM. Factors affecting employment at initiation of dialysis. *Clinical journal of the American society of nephrology*. 2011;6(3):489-96. <https://doi.org/10.2215/cjn.02550310>
 46. Abdul Raheem T, Ali K, Abdul Rasoul S, et al. Depression in Iraqi hemodialysis patients. *Arab journal of nephrology and transplantation*. 2013;6(3):169-72.
 47. Burnier M, Pruijm M, Wuerzner G, et al. Drug adherence in chronic kidney diseases and dialysis. *Nephrol Dial Transplant*. 2015;30(1):39- 44. <https://doi.org/10.1093/ndt/gfu015>
 48. Al-Hussaniy HA, Mohammed ZN, Alburghaif AH, Naji MA. Panax ginseng as Antioxidant and Anti-inflammatory to reduce the



- Cardiotoxicity of Doxorubicin on rat module. Research Journal of Pharmacy and Technology. 2022;15(10):4594-600.
49. Abdulmalik M, Sarah M, Najla A. Medication adherence among adult patients on hemodialysis. Saudi J Kidney Dis Transpl. 2014;25(4):762-8. <https://doi.org/10.4103/1319-2442.134990>
50. Awad M, Al-Hussaniy HA, Alburghaif AH, Tawfeeq KT. The role of COVID-19 in myopathy: incidence, causes, treatment, and prevention. Journal of Medicine and Life. 2022;15(12):1458. <https://doi.org/10.25122/jml-2022-0167>
51. Yoke M, Mohd S, Sing Z. Determinants of Compliance Behaviors among Patients Undergoing Hemodialysis in Malaysia. PLoS ONE.2012;7(8):1-7. <https://doi.org/10.1371/journal.pone.0041362>
52. Mohammed ZN, Al-Hussaniy HA, Oraibi AI. Assessment of Adherence to Medications and Prevalence of Depression Among Hemodialysis Patients. Indian Drugs. 2024;61(7): 69-78 DOI: 10.53879/id.61.07.14268
53. Ahmed MS, Reyadh AR, Shareef BQ, Ali AR, Hany AH, Meena AN. Increasing Prevalence of Congenital Hypothyroidism in children with Down Syndrome who have a family history of Thyroid disease. Research Journal of Pharmacy and Technology. 2023;16(3):1327-32. DOI: 10.52711/0974-360X.2023.00218
54. Baraz S, Parvardeh S, Mohammadi E, Broumand B. Dietary and fluid compliance: an educational intervention for patients having haemodialysis. Journal of advanced nursing. 2010;66(1):60-8. <https://doi.org/10.1111/j.1365-2648.2009.05142.x>
55. Al-Hussaniy HA. The Effect of MicroRNA-409-3p for Treatment and Response to Tumor Proliferation of Lung Cancer Cell Lines (In Vitro). Asian Pacific Journal of Cancer Prevention: APJCP. 2022;23(9):3151. <https://doi.org/10.31557/apjcp.2022.23.9.3151>
56. Ghimire S, Castelino RL, Lioufas NM, Peterson GM, Zaidi ST. Non-adherence to Medication Therapy in Haemodialysis Patients: A Systematic Review. PLoS One. 2015;10(12):e0144119. <https://doi.org/10.1371/journal.pone.0144119>