Original Article

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Nutritional status in Iraqi hemodialysis patients

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ABSTRACT

Background: Malnutrition is a commonly encountered issue in patients with chronic kidney disease (CKD) and significantly impacts disease progression and mortality. We aimed to assess the prevalence and severity of malnutrition among Iraqi patients on a regular hemodialysis (HD) program. **Aim**: This study aims to evaluate the level of malnutrition among hemodialysis patients across all Iraqi centers. **Methods**: A cross-sectional study conducted across all Iraqi cities from January 1 to December 31, 2023, examined patients undergoing HD. A standardized questionnaire was utilized for data collection, which was centralized through governorate centers. **Results**: Using subjective global assessment (SGA), 3,639 patients (33.9%) in Group A (well-nourished), comprised 2,053 (19.15%) males and 1,586 females (14.79%). Group B (mild/moderately malnourished) with 4,526 patients (42.2%) included 2,399 males (22.38%) and 2,127 females (19.84%). Group C (severely malnourished) with 2,556 (23.8%) patients included 1,544 males (14.4%) and 1,012 females (9.4%). The pre-dialysis weight for males was 68.55 ± 11.37 kg, while it was 66.62 ± 11.95 kg for females. The post-dialysis weight after ultrafiltration was 66.95 ± 11.6 kg for males and 64.76 ± 12.09 kg for females. The mean height for males was 169.2 ± 7.15 cm, while females had a mean height of 155.75 ± 5.82 cm. The body mass index (BMI) among males was lower than that of females, with means of 23.18 ± 4.32 and 26.03 ± 5.12, respectively. Cholesterol levels indicated that female patients had higher levels than male patients, with mean cholesterol levels of 195.3 ± 18.24 mg/dL for males and 210.72 ± 39.55 mg/dL for females. Additionally, the serum albumin level for male patients was 3.32 ± 0.43, lower than that of female patients. Pre-dialysis renal function tests indicated blood urea levels of 182.83 ± 42.67 mg/dL for males and 182.13 ± 55.76 mg/dL for females. Serum creatinine levels were 8.8 ± 2.5 mg/dL for males and 7.2 ± 2.51 mg/dL for females. Serum calcium levels were higher among male patients, with a mean of 7.27 ± 2.1 mg/dL, while among female patients, the mean serum calcium level was 7.09 ± 1.89 mg/dL. Hematocrit (Hct) levels for male patients averaged 27.18 ± 5.07, while female patients had a mean Hct level of 27.9 ± 6.08. **Conclusion**: The study found that 66.1% participants exhibited some form of malnutrition, consistent with trends observed across the Middle East. Low serum albumin levels were identified, reflecting an inverse relationship between albumin levels and nutritional status. The prevalence is highlighted, attributed to factors, such as chronic inflammation, altered nutrient metabolism, and deficiencies in key nutrients.

Keywords: hemodialysis (HD), subjective global assessment (SGA), malnutrition, Iraq.

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INTRODUCTION

Chronic kidney disease (CKD) is a clinical condition characterized by persistent changes in kidney function and/or structure, leading to irreversible and gradual progression over time. A significant aspect of CKD is its association with elevated risks of complications and mortality, particularly cardiovascular complications.[1,2] Diagnosis of CKD in adults is based on specific criteria observed for at least three months.[3]

A glomerular filtration rate (GFR) lower than 60 ml/min/1.73 m^2 or a GFR higher than 60 ml/min/1.73 m^2 accompanied by evidence of renal structural damage, which may include albuminuria, abnormalities in renal imaging, hematuria/leukocyturia, persistent electrolyte imbalances, histological changes observed in kidney biopsy, and previous kidney transplant history.[4,5]

Until the disease progresses, many individuals with CKD show no symptoms. Some may only become aware of their CKD during routine medical assessments such as regular health check-ups or examinations.
Several important components are involved in the therapy of individuals with CKD: [7]

Patient Care
Reducing the progression of CKD: Strategies to slow down the progression of CKD are essential in managing the disease. This may involve medications, blood pressure control, and lifestyle changes.

1. Treating complications related to the pathology: CKD can lead to various complications, including mineral and bone disorders, anemia, metabolic acidosis, hydro-electrolytic imbalances, and cardiovascular disease.
2. Kidney replacement therapy (KRT) preparation: For patients with advanced CKD, particularly those nearing end-stage renal disease, preparation for renal replacement therapy is crucial. This may involve education about different treatment options such as dialysis or kidney transplantation, as well as addressing any concerns or questions the patient may have.
3. Establishing an immunization routine: Patients with CKD are at increased risk of infections. Hence, establishing an immunization routine, especially for diseases like hepatitis B, is vital to prevent complications.

It's crucial to emphasize the importance of a multidisciplinary team in the care of CKD patients. This team typically includes professionals from various disciplines, such as nutrition, nursing, psychology, and social assistance. Collaborative care ensures comprehensive support for the patient, addressing their psychosocial needs, quality of life, and medical needs simultaneously.[8-10]

Hemodialysis
Over a million people with End-Stage Kidney Disease (ESKD) can now survive with the help of hemodialysis, which has transformed patient care in cases where kidney function is severely impaired or absent. Its evolution from a short-term treatment to a long-term KRT has significantly impacted nephrology and led to the emergence of a distinct field within medical science, often referred to as the physiology of the artificial kidney.[11,12]

Malnutrition in hemodialysis patients
Among the many potential complications of hemodialysis, a significant challenge faced by patients undergoing dialysis is malnutrition, with a global prevalence ranging from 28% to 54%. This condition significantly increases the risk of mortality, with odds ranging from 1.61 to 4.08. Malnutrition adversely affects the quality of life, increases frailty, and elevates the risk of infections and mortality among these patients (18,19). Unlike malnutrition observed in acute cases of hospitalization and critical illness, malnutrition in dialysis patients develops through various pathways. It originates from the progressive nature of CKD, the implementation of low-protein diets to slow CKD progression, and the prolonged period of dialysis treatment for ESKD patients. Dialysis treatment itself contributes to malnutrition through factors such as dialysis-induced nutrient losses, multiple dialyzer reuse, dialysis-induced inflammation, and the effectiveness of correcting uremia and metabolic acidosis. Non-iatrogenic factors, including suboptimal dietary intake, taste alterations, poor appetite, insulin resistance, and psychosocial factors, also play a role in the development of malnutrition in these patients.[12,13]

MATERIALS AND METHODS

Study Design
A cross-sectional study was conducted in all cities of Iraq during the period from January 1 to December 31, 2023.

Study Population.
The study population included all patients who underwent hemodialysis (HD) in Iraq during the specified period across all the cities of Iraq.

Inclusion Criteria
All adult patients with ESKD who underwent regular hemodialysis in all cities of Iraq.

Exclusion Criteria
Patients who underwent emergency HD, peritoneal dialysis, or continuous KRT (CKRT) were excluded from this study.

Data Collection and Questionnaire

Data were collected using a semi-structured, pre-prepared questionnaire. The questionnaire was designed by the authors after an extensive literature review based on previously published studies. Subsequently, the questionnaire underwent further analysis, revision, and editing based on feedback from a consultant specialist.

The data were compiled using reported information from the governorate centers in each city of Iraq.

The collected information included:

1. Age
2. Gender
3. Marital status
4. HD sessions/week & hours/week
5. Anthropometric measures
   a. Pre-dialysis weight
   b. Post-dialysis weight
   c. Height
   d. BMI was calculated accordingly.
6. The subjective global assessment (SGA) is typically calculated based on a combination of subjective observations and patient-reported information.
   a. Points were assigned to various indicators based on the severity of their presentation. For example:
   i. Weight loss: No weight loss (< 5%) (0 points), mild to moderate weight loss (5–10%) (1 point), severe weight loss (> 10% in 6 months) (2 points)
   ii. Dietary intake: Normal intake (0 points), reduced intake without evidence of malnutrition (1 point), inadequate intake due to malnutrition (2 points)
   iii. Gastrointestinal symptoms: None (0 points), mild to moderate symptoms (1 point), severe symptoms affecting food intake (2 points)
   iv.
   v. Functional capacity: Normal (0 points), some impairment in activities of daily living (1 point), severe impairment (2 points)
   b. The scores for each indicator were added up.
   c. The SGA score was interpreted to classify the patient's nutritional status into one of three categories:
   i. Well-nourished: SGA score of 6–7
   ii. Moderately malnourished: SGA score of 3–5
   iii. Severely malnourished: SGA score of 1–2
7. Biochemical parameters included:
   a. Cholesterol level
   b. S. calcium level
   c. Pre-dialysis blood urea level
   d. S. creatinine.
   e. Hematocrit level.
   f. S. albumin level.
8. Etiology of the disease.

Statistical Analysis

Data were cleansed and examined for any missing values before entry. The data were then entered into Microsoft Excel and exported to SPSS version 26 statistical software for analysis. Descriptive analysis was performed to yield frequency distributions and percentages for qualitative data and means and standard deviations (SD) for quantitative data.

Categorical variables were analyzed using Chi-square tests. Continuous variables were analyzed using T-tests when needed. A P value of < 0.05 was accepted as statistically significant in all tests. (Fig. 3)

RESULTS

Nutritional Assessment and Anthropometric Measurement

Male patients weighed 68.55 ± 11.37 kg before dialysis, while female patients weighed 66.62 ± 11.95 kg. After ultrafiltration, the post-dialysis weight for males was 66.95 ± 11.6 kg, while the post-dialysis weight for females was 64.76 ± 12.09. (Fig. 1)

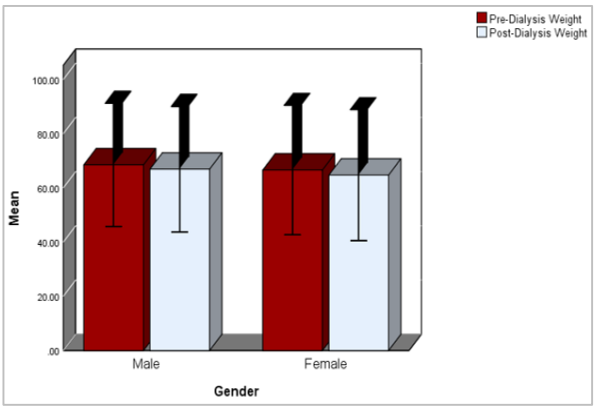

Figure 1: Pre-Dialysis vs post-Dialysis weight for patients who underwent HD in 2023, Iraq.

Using the subjective global assessment (SGA), 3,639 patients were classified as Group A (well-nourished), comprising 2,053 males (19.15%) and 1,586 females (14.79%). Group B (mild/moderately malnourished)

included 4,526 patients (42.2%), with 2,399 males (22.38%) and 2,127 females (19.84%). Group C (severely malnourished) included 2,556 patients (23.8%), including 1,544 males (14.4%) and 1,012 females (9.4%). (Fig. 2)

The height of patients who underwent hemodialysis, with a mean height for males of (169.2 ± 7.15) centimeters, while females were shorter, with a mean height of (155.75 ± 5.82) centimeters. (Fig. 3)

Body mass index (BMI) among males was lower than that of females, with means of (23.18 ± 4.32) and (26.03 ± 5.12), respectively. (Fig. 4)

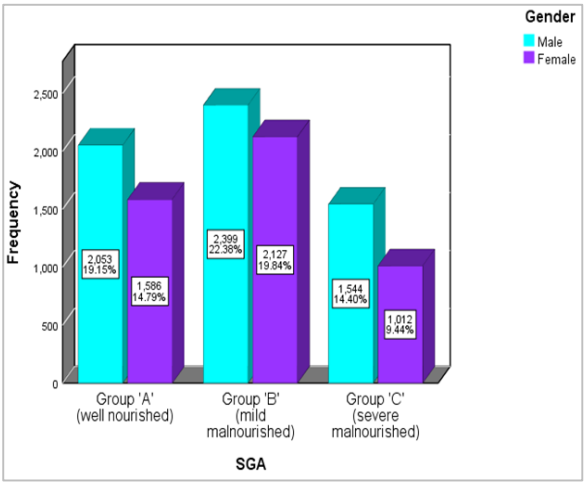

Figure 2: The Subjective Global Assessment (SGA) for patients who underwent HD in 2023, Iraq.

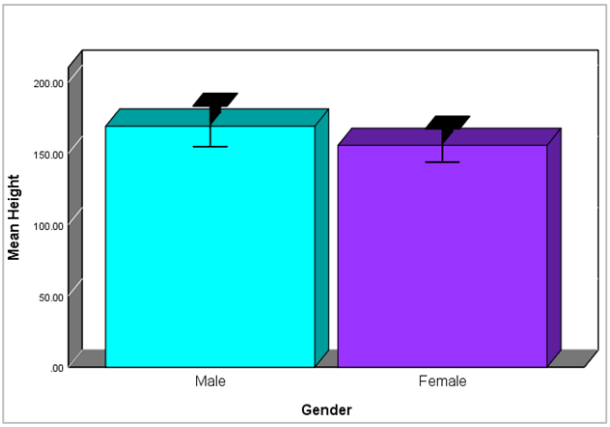

Figure 3: Height for patients who underwent HD in 2023, Iraq.

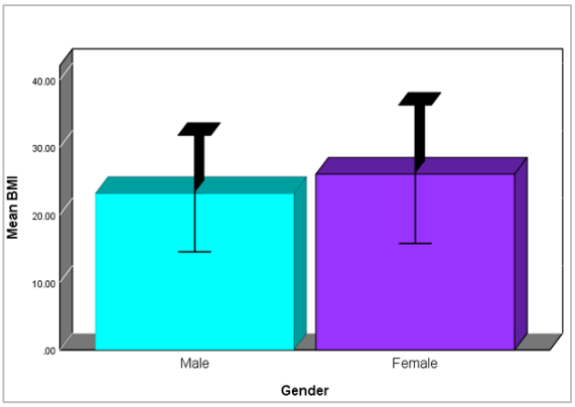

Figure 4: BMI for patients who underwent HD in 2023, Iraq.

Biochemical Parameters

The measurement of cholesterol levels among patients revealed that females had higher levels than males, with mean levels for males being (195.3 ± 18.24) mg/dL and female patients being (210.72 ± 39.55) mg/dL.

Similarly, the serum albumin level for male patients was (3.32 ± 0.43), which was lower than that of female patients, who showed a mean of (3.49 ± 0.918). Pre-dialysis renal function tests showed a B. urea level of (182.83 ± 42.67) mg/dL for males and (182.13 ± 55.76) mg/dL for females.

Alternatively, serum creatinine levels for male patients were (8.8 ± 2.5) mg/dL and for female patients, it was (7.2 ± 2.51) mg/dL. Serum calcium level (S. Ca levels) measurement showed higher levels among male patients, with a mean of (7.27 ± 2.1) mg/dL, while female patients had a mean serum calcium level of (7.09 ± 1.89) mg/dL.

Measurement of the hematocrit (Hct) levels for male patients showed a mean of (27.18 ± 5.07) while female patients showed a mean Hct level of (27.9 ± 6.08).

Inferential Analysis

Subjective global assessment (SGA) scores and gender showed a highly statistically significant difference with a P value of 0.001, as shown in table 1.

For the assessment of the association for gender between the anthropometric measures, there was a highly statistically significant difference for each measure, including pre-dialysis (pre-dialysis weight, post-dialysis weight, height, and BMI) with a P value of 0.001. (Table 2)

Table 1: The association of gender with Subjective Global Assessment (SGA) for patients who underwent HD in 2023, Iraq.

			Gender		Total	Pearson Chi-square	P value
			Male	Female			
SGA	Group 'A' well-nourished)	Fr	2053	1586	3639	36.845	0.001
		%	19.1%	14.8%	33.9%		
	Group 'B' (mildly malnourished)	Fr	2399	2127	4526		
		%	22.4%	19.8%	42.2%		
	Group 'C' (severely malnourished)	Fr	1544	1012	2556		
		%	14.4%	9.4%	23.8%		
Total		Fr	5996	4725	10721		
		%	55.9%	44.1%	100.0 %		

Table 2: The association of gender with anthropometric measures of patients who underwent HD in 2023, Iraq.

	Gender	Mean	Std. Deviation	Std. Error Mean	T-test	P-value
Pre-Dialysis Weight	Male	68.55	11.378	.14695	8.46	0.001
	Female	66.62	11.958	.17398		
Post-Dialysis Weight	Male	66.95	11.606	.14989	9.469	0.001
	Female	64.76	12.097	.17599		
Height	Male	169.2	7.15	.09234	107.3	0.001
	Female	155.75	5.826	.08476		
BMI	Male	23.18	4.321	.05580	30.7	0.001
	Female	26.03	5.120	.07450		

DISCUSSION

In this study, malnutrition among patients undergoing hemodialysis (HD) was assessed using the subjective global assessment (SGA), revealing that 66.1% of participants exhibited some form of malnutrition. This result confirms earlier research conducted in Iraq, which reported that approximately 49.8% of the study population had varying degrees of malnutrition.[13]

Furthermore, a study by Al-Saedy et al. in 2011 corroborated these findings, demonstrating a slightly lower prevalence of 63.5% of patients with HD in Iraq.[14] Interestingly, similar trends were observed in other countries within the region. For instance, the prevalence of malnutrition among HD patients was reported to be 67% in Egypt, 65% in Palestine, and 55% in Saudi Arabia, while it was much lower in countries like Turkey (36.4%) and Iran (36%).[13-19]

These findings emphasize the significant burden of malnutrition among HD patients across the Middle East, highlighting the need for targeted nutritional interventions and supportive care strategies. The region has a high prevalence of chronic illnesses, including hypertension and diabetes, which are the main drivers of end-stage kidney disease (ESKD) and may contribute to the malnutrition observed in HD patients.

These conditions can impair kidney function and increase the risk of malnutrition, particularly if dietary and lifestyle modifications are not effectively implemented.

It could also be due to insufficient access to hemodialysis across these countries, supported by the findings of this study, which showed a large proportion of patients underwent hemodialysis only two sessions/week (71.8%). This is because of the high number of patients in need of hemodialysis; current local guidelines provide three sessions/week only for those who are anuric and in significant need of three sessions/week. Fewer sessions for patients could impact their nutritional status.

A study by Mousa et al. in Baghdad; 2021, which involved 271 patients, showed that 56% of patients had two sessions/week of hemodialysis, which is lower than that reported in this study but still high.[13] The difference between the studies could be attributed to sample size differences; Mousa's study only involved four centers in Baghdad, while this study was a nationwide study, which could be another reason.

The level of serum albumin is often regarded as a key indicator of nutritional status among patients undergoing hemodialysis, in addition to serum calcium, blood hemoglobin, and serum creatinine. In this study, patients exhibited mean serum albumin levels ranging between 3.32 to 3.49 g/dL for males and females. In a separate study in 2020 in Baghdad, the mean serum albumin level among the study group was reported to be 3.8 g/dL (80). Additionally, findings from a study

conducted in Alexandria revealed a mean serum albumin level of 3.24 g/dL, which is similar to that of this study.[20] This observation aligns with previous research documenting an inverse relationship between albumin levels and nutritional status. Specifically, studies have highlighted that lower albumin levels are indicative of poorer nutritional status among hemodialysis patients.[21] It is important to recognize that while serum albumin concentration also serves as a powerful indicator of mortality risk in hemodialysis patients, it cannot solely determine nutritional adequacy.[22]

Various factors contribute to the generation and catabolism of albumin, including inhibited synthesis in the uremic environment, increased degradation, and dilution from edema fluid.[23] Therefore, the significant inverse association between serum albumin levels and malnutrition observed in our study, as well as in previous studies, may not solely reflect poor dietary intake and inadequate dialysis sessions for patients with poor prognosis.

Similarly, hemoglobin level is an important indicator of nutritional status. In this study, the mean hemoglobin (Hb) levels for male patients were measured at approximately 9.06 g/dL and for female patients at around 9.3 g/dL. Comparatively, another study from Iraq reported a mean hemoglobin level of 8.9 g/dL among the study group. This finding falls below the recommended target range of 10–12 g/dL according to KDIGO guidelines for patients undergoing hemodialysis. The observed discrepancy between this study and the established target range highlights the prevalence of anemia among hemodialysis patients, often attributed to factors such as poor nutritional intake. The cause of anemia in patients undergoing hemodialysis could be due to chronic kidney disease (CKD), which leads to decreased production of erythropoietin (EPO) by the kidneys, stimulating red blood cell production in the bone marrow. Additionally, hemodialysis itself can cause mechanical damage to red blood cells as they pass through the dialysis machine. Malnutrition and deficiencies in key nutrients such as iron, vitamin B12, and folate can impair erythropoiesis and contribute to anemia. Altered nutrient metabolism in CKD patients further exacerbates nutritional deficiencies.[24] Furthermore, patients receiving hemodialysis frequently develop chronic inflammation, indicated by increased levels of inflammatory mediators such as tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6). They also frequently develop iron deficiency due to blood loss during dialysis, inadequate dietary intake, and impaired absorption of iron from the gastrointestinal tract.[24,25]

Blood calcium levels were measured in this study, with mean values for males and females being 7.27 mg/dL and 7.09 mg/dL, respectively. Conversely, another study found that the study group's mean calcium level was greater, at 8.7 mg/dL.[26]

There could be several reasons for the disparity in calcium levels between the two studies, such as differences in patient demographics, underlying illnesses, dietary preferences, and even discrepancies in laboratory measuring methods.

Lower calcium levels could be due to malnutrition and chronic inflammation, which can adversely affect calcium homeostasis. Reduced nutritional intake and altered metabolism associated with inflammation can disrupt calcium absorption, utilization, and distribution in the body. Patients undergoing hemodialysis also often follow dietary restrictions, including reduced intake of calcium-rich foods. [27] Another reason could be that hemodialysis patients frequently take phosphate binders to control serum phosphate levels. Some phosphate binders, such as calcium-based binders, can bind dietary calcium in the gut, reducing its absorption and leading to lower serum calcium levels.[28]

S. creatinine levels ranged from 8.8 mg/dL in male patients to 7.2 mg/dL in female patients. This is similar to the findings of Al-Saedy, which showed mean values of 8.11 mg/dL for serum creatinine levels in male patients and 7.42 mg/dL in female patients.[14]

The association between Subjective Global Assessment (SGA) scores and gender was shown to be extremely statistically significant.

Data from studies conducted in Jordan and Turkey also indicated a statistically significant association between malnutrition and gender.[29,30]

CONCLUSIONS

Malnutrition among hemodialysis patients was assessed utilizing Subjective Global Assessment (SGA), revealing that 66.1% of participants exhibited some form of malnutrition. Consistent trends in malnutrition prevalence across the Middle East. Lower blood albumin levels were found in the study, which aligns with the notion that albumin levels and nutritional status are inversely related. The prevalence is highlighted, attributed to factors such as chronic inflammation, altered nutrient metabolism, and deficiencies in key nutrients.

Recommendations

1. Improving the accuracy and reliability of reported cases of hemodialysis in Iraq is essential for assessing the burden of end-stage renal disease (ESRD) and planning appropriate healthcare interventions. This could be achieved by implementing standardized reporting protocols for collecting data on hemodialysis cases nationwide. Training and capacity-building initiatives for healthcare professionals involved in data collection and reporting should be provided. Strengthening public health surveillance systems to track trends and patterns of hemodialysis prevalence and associated risk factors is also necessary. Inconsistencies and inaccuracies in reporting may undermine the validity of prevalence estimates and hinder efforts to allocate resources effectively.
2. Conducting longitudinal studies to track changes in the prevalence of hemodialysis over time and to assess the impact of interventions aimed at improving access to healthcare and managing chronic kidney disease (CKD) is recommended.
3. Due to the lower prevalence of hemodialysis in Iraq compared to neighboring countries, investment in strengthening healthcare infrastructure is crucial, including the expansion of hemodialysis facilities, training of healthcare professionals, and procurement of essential medical equipment and supplies.
4. Prioritizing preventive care and health promotion initiatives to address modifiable risk factors associated with chronic kidney disease (CKD), such as diabetes, hypertension, and obesity, is essential. Enhancing patient education and empowerment initiatives to improve health literacy, treatment adherence, and self-management skills among individuals with kidney disease is also vital.

Limitations of the Study

1. The study may have suffered from underreporting of hemodialysis cases due to limitations in the reporting system. Inaccuracies and inconsistencies in data collection and recording could lead to incomplete datasets, resulting in an underestimation of the true prevalence of hemodialysis in Iraq.
2. The study may have encountered variability in reporting practices across different healthcare facilities and regions in Iraq. Variations in data collection methods, documentation standards, and reporting protocols could introduce bias and discrepancies in the reported prevalence rates of hemodialysis, compromising the reliability of the findings.

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