

Studying the effect of dialysis modality on some parameters in dialysis patients with Diabetes Mellitus type 2

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ABSTRACT

Diabetes mellitus (DM) was considered one of the most frequent metabolic disorders worldwide. Type 2 DM was associated with hyperglycemia due to defects in insulin secretion and response. DM was identified as the most prevalent cause of end-stage renal disease (ESRD). Nearly 40% of dialysis patients were reported to suffer from diabetic nephropathy. The incidence of ESRD in patients with DM was found to be 10-fold higher compared to nondiabetic subjects. Across-sectional study was conducted from January 2024 to May 2024. A total of 127 samples were randomly selected from both sexes, aged between 35 - 80 years and were collected from Hospital in Karbala Province and Diwaniya Province. Each sample was evaluated individually using a case sheet that included the patient's name, age, smoking status, presence of other diseases and details of drugs and their doses. The results of this study indicate that the percentage of adults is higher than that of elderly individuals. It also shows that individuals taking oral medications are more prone to kidney failure than those receiving insulin intravenously, and that individuals undergoing dialysis three times a week have a higher percentage compared to those undergoing dialysis more than three times a week.

Keywords: Diabetes Mellitus, dialysis patients, hemodialysis, insulin resistance

1.Introduction

One of the most common metabolic diseases in the world is diabetes mellitus (DM). Hyperglycemia is linked to type 2 diabetes because of abnormalities in insulin output and response. Reduced beta-cell activity and insulin resistance (IR) are associated with the pathophysiology of age-related DM type 2. The most common cause of end-stage renal disease (ESRD) is DM. Diabetic nephropathy affects about 40% of dialysis patients. Compared to individuals without diabetes, the incidence of ESRD is ten times higher in DM patients. Patients receiving haemodialysis (HD) or peritoneal dialysis (PD) are more likely to die if they had preexisting diabetes. Extracorporeal renal replacement therapy can be replaced with PD. One of the most common metabolic diseases in the world is DM. Hyperglycemia is linked to type 2 diabetes because of abnormalities in insulin output and response. The pathogenesis of age-related DM type 2 is linked with IR and decreased beta-cell function [1,2].

Over the past few decades, this condition has become more common in all age groups [3]. Between 2011 and 2014, between 366 and 422 million people have diabetes. It is projected that there will be 522 million diabetic patients in 2030 and 592 million in 2035 [4, 5]. The most common cause of ESRD is diabetes mellitus [6]. Diabetic nephropathy affects about 40% of dialysis patients [7]. Compared to persons without diabetes, the incidence of ESRD is ten times higher in DM patients [8]. In HD and PD patients, preexisting DM is linked to higher mortality [9]. Extracorporeal renal replacement therapy can be replaced with PD. The glucose load is significantly increased in Parkinson's disease due to the regular use of glucose-based fluids. These days, DM is thought to be one of the most frequent causes of ESRD. When a person has ESRD, their kidneys are unable to adequately respond to the demands of daily life. One of the most significant and potentially fatal illnesses, ESRD typically follows chronic kidney disease [10,11]. More than half of ESRD patients in a research done in the USA were caused by diabetes [12], while in a study done in Khuzestan, Iran, diabetes was the most prevalent cause of disease, with glomerulonephritis accounting for roughly 10% of cases [13]. Dialysis's primary goal is to lower the blood's concentration of uremic toxins, particularly tiny and medium-sized molecules. Additionally, it controls metabolic disorders and reduces the patient's fluid volume by

ultrafiltration [14,15]. This study is aimed to identify and study the extent of the relationship between DM and hemodialysis.

2. Materials and Methods

Study Design

A cross-sectional study was conducted from January 2024 to May 2024. A total of 127 patients with DM-T2, of both sexes and aged between 35 and 80 years, were selected from Al-Hussain Teaching Hospital and Al-Hassan Al-Mujtaba Teaching Hospital in Karbala Province, as well as from Al-Hussain Teaching Hospital and Al-Diwaniya Teaching Hospital in Diwaniya Province. Patients were given intravenous blood samples. A case sheet with the patient's name, age, smoking status, presence of additional illnesses, and information about medications and dosages was used to examine each sample separately. Each sample was evaluated individually using an Excel sheet.

Statistical Analysis

Statistical analysis was performed using the Chi-square test. P values less than 0.05 were considered statistically significant [16].

3. Results and Discussion

Demographic data including, antidiabetic drug usage, gender, age group, smoking status, and dialysis modality, numbers of dialysis, another disease. According to Table (1). There were significant differences between the high proportion of participants (74.8%) taking antidiabetic medications suggesting that diabetes management is a major concern in this population perhaps, perhaps due to its association with chronic kidney disease or dialysis requirements. The preference for oral hypoglycemic medications over insulin (70.1% vs. 29.9%) may indicate that most participants is in the early or moderate stages of diabetes control. The study contains a relatively balanced gender distribution with the proportion of men slightly higher (52.8%). The majority of participants were adults (61.4%), reflecting that dialysis affects a larger adult population, but older adults (38.6%) remained a significant proportion, highlighting the chronic nature of diseases requiring dialysis. Seriously, the large proportion of non-smokers (83.5%) may indicate effective public health measures or changes in health behavior following the diagnosis of chronic diseases. Most participants underwent dialysis three times a week (64.6%) in accordance with standard dialysis protocols. Peritoneal dialysis (60.6%) is more common than

hemodialysis (39.4%), possibly due to patient preferences, accessibility, or physician recommendations. As show table (1) and Figure (1).

Table 1. Various factors like antidiabetic drug usage, gender, age group, smoking status and dialysis modality for experimental samples in dialysis patients with DM type 2

Variables	Category	N (%)
Taken antidiabetic drug	No	32 (25.2)
	Yes	95 (74.8)
Drug name	Insulin	38 (29.9)
	Oral hypoglycemic drugs	89 (70.1)
Gender	Male	67 (52.8)
	Female	60 (47.2)
Age group	Adult	78 (61.4)
	Elderly	49 (38.6)
Smoker	No	106 (83.5)
	Yes	21 (16.5)
Number of dialysis	<3	45 (35.4)
	3	82 (64.6)
Another disease	Hypertension (HT)	93 (73.2)
	HT and other	34 (26.8)
Dialysis modality	Hemodialysis	50 (39.4)
	Peritoneal	77 (60.6)

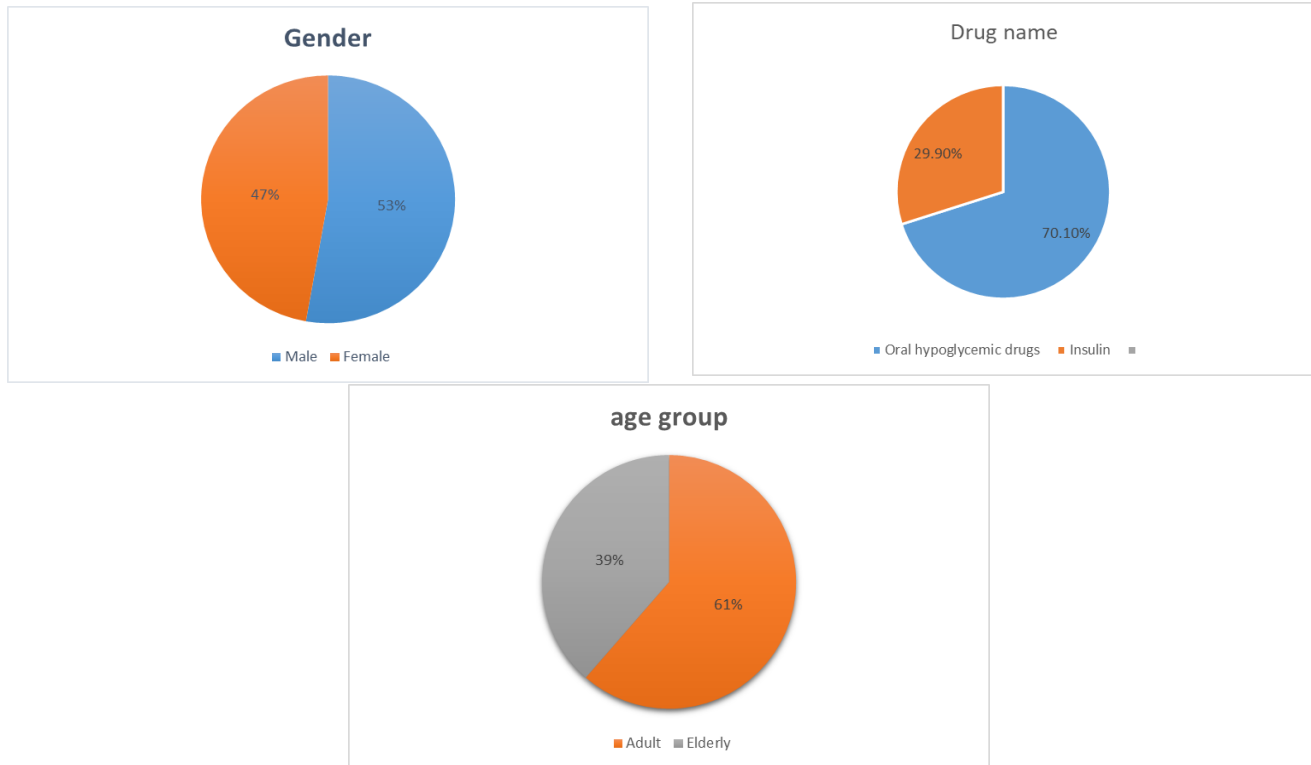


Figure 1. Various factors like antidiabetic drug usage, gender, age group for experimental samples in dialysis patients with DM type 2

Table (2) demonstrates that no statistically significant difference was observed between dialysis modalities with respect to the use of antidiabetic medications ($p = 0.191$), indicating that the choice of dialysis modality does not substantially influence the requirements for glycemic management. Likewise, the type of antidiabetic therapy (insulin versus oral hypoglycemic drugs) was not significantly associated with the selected dialysis modality ($p = 0.157$). Furthermore, gender distribution did not differ significantly between hemodialysis and peritoneal dialysis groups ($p = 0.483$), suggesting that gender does not represent a determining factor in the selection of dialysis modality. In contrast, a statistically significant difference was identified in the distribution of age groups between the two modalities ($p = 0.036$). Elderly participants preferred peritoneal dialysis more (71.4%), due to its less invasive nature and home administration, thus reducing the need for frequent hospital visits. Adults were evenly distributed between the two methods, although a slight predominance of peritoneal dialysis (53.8%) was observed. Although the correlation did not reach statistical significance ($p = 0.195$) the

proportion of smokers among patients undergoing peritoneal dialysis was higher (71.4%). This finding may reflect lifestyle considerations or clinical recommendations; However, further investigation is needed to clarify this relationship. As shown in Figure 2.

Table 2. Correlation between clinical and demographic variables (use of antidiabetic drugs, gender and smoking status) and dialysis method in patients with type 2 diabetes.

Variables	Category	Dialysis modality	N (%)	p-value
Taken antidiabetic drug	No	Hemodialysis	10 (31.3)	0.191
		Peritoneal	22 (68.8)	
	Yes	Hemodialysis	40 (42.1)	
		Peritoneal	55 (57.9)	
Drugs name	Insulin	Hemodialysis	18 (47.4)	0.157
		Peritoneal	20 (52.6)	
	Oral hypoglycemic drugs (OHD)	Hemodialysis	32 (36)	
		Peritoneal	57 (64)	
Gender	Male	Hemodialysis	27 (40.3)	0.483
		Peritoneal	40 (59.7)	
	Female	Hemodialysis	23 (38.3)	
		Peritoneal	37 (61.7)	
Age group	adult	Hemodialysis	36 (46.2)	0.036
		Peritoneal	42 (53.8)	
	Elderly	Hemodialysis	14 (28.6)	
		Peritoneal	35 (71.4)	
Smokers	No	Hemodialysis	44 (91.5)	0.195
		Peritoneal	62 (58.5)	
	Yes	Hemodialysis	6 (28.6)	
		Peritoneal	15 (71.4)	

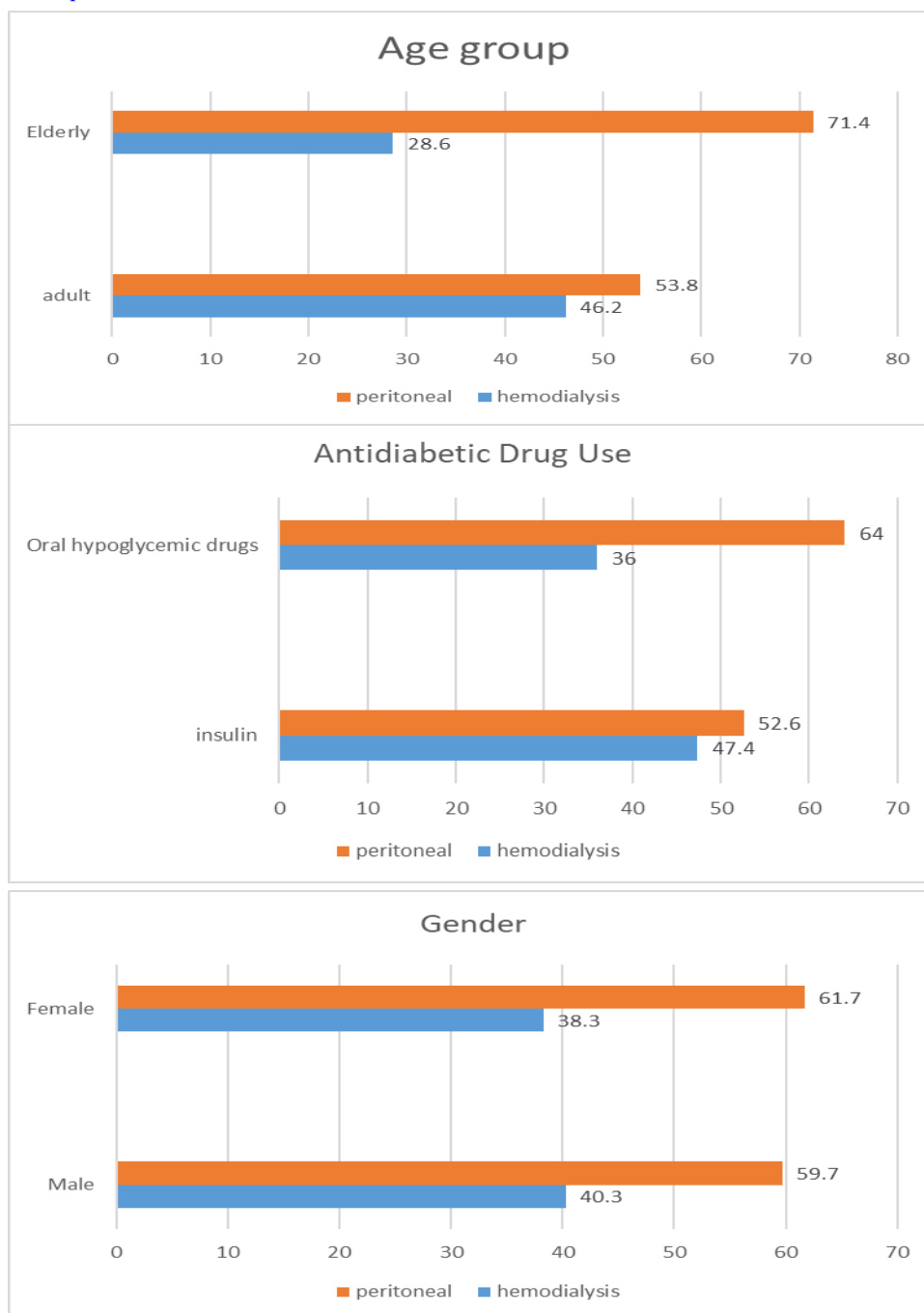


Figure 2. Relationship between clinical and demographic variables (use of antidiabetic drugs, gender and age) in dialysis patients with type 2 diabetes.

Table 3 shows the biochemical parameters evaluated to evaluate the clinical status, status of patients and the possible effect of different dialysis methods.. Mean serum albumin levels were slightly higher in the hemodialysis group (3.6620 g/dL) compared with the peritoneal dialysis

group (3.56 g/dL); however, this difference did not reach statistical significance ($p = 0.244$), indicating comparable maintenance of protein status between the two modalities. Serum ferritin levels, that reflect iron stores, did not show significant differences between groups ($p = 0.800$), suggesting that anemia-related parameters can be treated similarly in both dialysis modes. Seriously, Although not statistically significant ($p = 0.077$), the mean blood glucose level was higher among patients receiving peritoneal dialysis (215.42 mg/dL) than among those receiving hemodialysis (175.12 mg/dL). This observation is due to increased glucose uptake of peritoneal dialysis solutions, a known metabolic effect of this method. A statistically significant difference in blood urea levels was observed ($p = 0.035$), higher mean values were reported in the peritoneal dialysis group (130.78 mg/dL) than in the hemodialysis group (127.64 mg/dL). Although the absolute difference was modest, it MAY reflect differences in urea removal efficiency between the two treatment approaches. Plus a statistically significant difference was found in serum creatinine levels ($p = 0.055$) with a higher mean concentration in the hemodialysis group (9.31 mg/dL) than in the peritoneal dialysis group (6.59 mg/dL). This result may be related to differences in muscle mass distribution or method-specific clearance dynamics.

Table 3. Relationship between some biochemical parameters and dialysis method in dialysis PATIENTS with type 2 diabetes

Biochemical Analysis	Modality	Mean	Std. Deviation	P-value
Albumin	Hemodialysis	3.6620	0.60	0.244
	Peritoneal	3.56	0.45	
Ferritin	Hemodialysis	254.53	182.07	0.8
	Peritoneal	198.98	195.22	
Glucose	Hemodialysis	175.12	66.81	0.077
	Peritoneal	215.42	84.99	
Urea	Hemodialysis	127.64	29.08	0.035
	Peritoneal	130.78	35.30	
Creatinine	Hemodialysis	9.31	22.56	0.055
	Peritoneal	6.59	2.06	

The high prevalence of antidiabetic drug use in the study population (74.8%) is consistent with reports that dialysis patients often have a high rate of diabetes, requiring frequent use of insulin and oral hypoglycemic agents (OHD). The finding that peritoneal dialysis patients were more likely to use OHD than hemodialysis patients (64% versus 36%) may reflect the different effects of each modality on glucose metabolism. Recent studies suggest that peritoneal dialysis patients often experience greater glucose fluctuations due to dextrose-based dialysis, that may make glycemic control more difficult compared to hemodialysis [17,18].

This study observed a relatively balanced gender distribution among dialysis methods with a slight male predominance. However the age distribution showed that elderly , elderly patients received peritoneal dialysis more often (71.4%) than hemodialysis (28.6%) that is consistent with the literature that peritoneal dialysis is increasingly chosen for elderly patients because it can be performed at home and can improve quality of life. These demographic patterns reflect trends documented in recent studies suggesting that peritoneal dialysis may be more appropriate for older adults who desire less intensive dialysis [19]. An important result was the prevalence of hypertension (HT) and other diseases 73.2% of patients presented with hypertension alone and 26.8% with HT and other conditions. The prevalence of hypertension is known to complicate dialysis and often influences the choice of dialysis. Previous studies have shown that treatment of HT is essential to improve dialysis outcomes especially as peritoneal dialysis patients are prone to fluid retention that can exacerbate HT. Given the association between comorbidities and dialysis outcomes these findings underscore the importance of individualized care strategies to address the specific health needs of dialysis patients[20] Biochemical analysis of dialysis patients revealed significant differences between modalities particularly in glucose urea and creatinine levels[21]. The higher glucose level in peritoneal dialysis patients (mean: 215.42 mg/dL) than in hemodialysis patients (mean: 175.12 mg/dL) is noteworthy and may be attributed to glucose uptake from the peritoneal dialysate that has been widely discussed recently. High glucose can lead to complications such as an increased risk , risk of cardiovascular disease underscoring the need for close monitoring of blood , blood glucose levels in peritoneal dialysis patients [22]. Urea and creatinine levels also showed notable differences, with slightly higher levels in peritoneal dialysis patients. High urea levels have been associated with increased morbidity in dialysis patients, suggesting that closer monitoring and tailored dialysis regimens may be

beneficial for individuals with elevated urea and creatinine [23]. Study findings underscore the importance of individualized treatment strategies for dialysis patients particularly when addressing comorbidities and biochemical differences between dialysis modalities. Given the need for glucose control in peritoneal dialysis patients clinicians should consider incorporating frequent glucose monitoring and adjustments into antidiabetic management. Furthermore differences in urea and creatinine levels suggest that biochemical monitoring should be method-specific to improve treatment efficacy [24,25].

Conclusion

The findings support that type 2 diabetes is a major global contributor to kidney disease and is now recognized as a major cause of kidney failure. Chronic hyperglycemia plays a major role in the pathogenesis of diabetic nephropathy, as a sustained increase in blood sugar gradually impairs the structural and functional integrity of the kidney's filtration units. This gradual deterioration eventually leads to reduced kidney function, leading to end-stage renal failure.

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