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Disorders of Kidney Functions Among Diabetic Patients with Type I and II in Tarhouna City

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خلل وظائف الكلى لدى مرضى السكري من النوع الأول والثاني في مدينة ترهونة

المستخلص:

داء السكري مرض مزمن يحدث عندما يعجز البنكرياس عن إنتاج الأنسولين بكمية كافية. عند ارتفاع السكر بالدم لدى المصابين بداء السكري فإن الأوعية الدموية (داخل النيفرون) والأعصاب تتأثر مع مرور الوقت، بالإضافة إلى أن تصفية كميات كبيرة من الجلوكوز يشكل عبئًا على الكلى، وبعد عدة سنوات يبدأ البروتين المفيد بالخروج مع البول، وفي الحالات المتأخرة يمكن أن يصل إلى مرحلة الفشل الكلوي. أجريت هذه الدراسة "دراسة مقطعية تحليلية" في الفترة من اكتو بر 2022 إلى ديسمبر 2022 بمركز السكر والغدد الصماء والمختبرات الخارجية الخاصة ترهونة- ليبيا. وكان الهدف من الدراسة تحديد نسبة مدى تأثير مرض السكري على وظائف الكلى وقد شملت الدراسة 130 عينة تم جمعها عشوائيا من مصل دم مرضى السكري وفحصت بجهاز قياس نسبة الأملاح في الجسم(Easylyte Plus Analyzer (USA, 2013; Medica Company وجهاز الكيمياء لتحليل السكر ووظائف الكلى في الدم (spectrophotometer 4040v50 plus machine) حيث كان عدد المصابين الذكور 65 والإناث 65 تتراوح أعمارهم ما بين 15-65 عاماً نسبة المصابين بفشل كلوي كانت 15 (8 ذكور،7 إناث) بنسبة 11.5%، حيث إن معظم مرضى السكري أغلبهم يقوم بالكشف الدوري لوظائف الكلى والالتزام بأخذ العلاج.

الاستنتاج: معظم مرضى السكري المشتركين بهذه الدراسة والذين يعانون من قصور كلوي لا يقومون بإجراء الرياضة ولديهم تاريخ عائلي للإصابة بداء السكري وتبين أنه لا يوجد فروقات معنوية لتأثير السكر على الكلى ولهذا اتضح بأن قيمة P.value قد كانت أكبر من 0.05، ولهذا يوصى الالتزام بأخذ أدوية مرض السكري كلاً حسب نوع العلاج، عمل الفحوصات الدورية لمراقبة وظائف الكلى، وممارسة النشاطات الرياضية.

الكلمات المفتاحية: *مرض الكلى المزمن، مرض الكلى السكري، أمراض القلب والأوعية الدموية.*

Abstract:

Background: This study was conducted in the period from October 2022 to December 2022 and aimed to evaluate kidney function in patients with diabetes mellitus in the private laboratories of Tarhuna.

Material and Methods: This study analyzed 130 patients with blood samples collected by venipuncture. Sugar, urea, and creatinine were measured by spectrophotometer 4040v5 plus, and sodium, potassium, and chloride were measured by Easylyte Plus analyzer. Data was analyzed using Microsoft Excel 2010 and SPSS version 22. Age,

gender, smoking, chronic diseases, duration of injury, family history, sports activity, and other information were collected by a questionnaire.

Results: The study showed that 61.5% had cases of diabetes in the family. Blood pressure was measured in 66.2% of the total patients, and it was found that 48.5% of the sample had complications from diseases. The study displayed that the percentage of insulin users was 79.2%, and almost 90.8% had abnormal blood sugar, 80.8% had abnormal creatinine, and finally, the most abnormal element among patients was sodium (4.6% of total patients).

Conclusion: The study reveals that diabetes doesn't significantly affect renal failure in a family diabetes group, with high blood pressure being the most common issue and 79.2% using insulin, as indicated by a P-value greater than 0.05.

Recommendation: taking diabetes medications according to the type of treatment and conducting periodic examinations to monitor kidney function, as well as the recommended practice of sports activities.

Keywords: *diabetic nephropathy, chronic kidney disease, diabetic kidney disease, cardiovascular diseases.*

Introduction:

Diabetes mellitus (DM) is a metabolic disease considered by chronic hyperglycemia as an end result of defects in insulin action, secretion, or both. DM currently affects more than 463 million people worldwide (9.3% of adults aged 20–79 years), and the number of patients with DM is estimated to get higher to 578 million by 2030 and 700 million by 2045. The World Health Organization (WHO) reported that DM is the leading cause of kidney failure globally (Gembillo et al., 2021). Diabetic kidney disease (DKD)—the clinical diagnosis of diabetes-driven kidney disease—occurs in up to 40% of individuals with diabetes and can lead to kidney failure, cardiovascular disease (CVD), and premature death (Oshima et al., 2021; East, & Africa, 2017). Chronic kidney disease (CKD) is one of the most frequent and serious complications in the evolution of patients with diabetes mellitus (Valencia, & Florez, 2017). Approximately 30% of patients with type 1 diabetes mellitus and 40% of those with type 2 diabetes mellitus develop some form of CKD (Forst et al., 2022). In general terms, diabetic nephropathy (DN) may be defined as a glomerulopathy associated with glomerulosclerosis, with some interstitial and tubular lesions also being observed, although glomerular alterations are the main ones in this process (Alicic et al., 2017). In the initial stages of DN, endothelial dysfunction occurs as well in the blood vessels of other organs, such as the retina, coronary arteries, etc. (Shah et al., 2022). Sustained hyperglycemia is recognized as the main origin of all the alterations that appear in the nephropathic complications of diabetic patients, which initiates the process that induces endothelial dysfunction and activates most of the biochemical mechanisms that lead to glomerular cell damage (Papadopoulou-Marketou et al., 2018). One of the biochemical pathways of cellular damage that induce high glucose levels is cellular oxidative stress, a mechanism recognized in almost all tissues of the organism in uncontrolled diabetes mellitus. Oxidative stress was shown to induce glomerular inflammation, which increases glomerular volume; moreover, oxidative stress leads to glomerular function failures, especially an increase in urinary protein excretion and a decrease in glomerular filtration fraction (Su et al., 2019; Andrade-Sierra et al., 2022). Taking into account the fundamental role of oxidative stress

in the onset and development of the renal complications of diabetes, both at the glomerular level and in the rest of the extrarenal blood vessels, the possibility of using antioxidant compounds to prevent these alterations in diabetes mellitus was postulated (Hernandez et al., 2022; Al-Waili et al., 2017).

Rational: Diabetes mellitus is a significant factor causing kidney failure, with 20-30% of Type I and II diabetes patients experiencing diabetic nephropathy. Kidney involvement increases end-stage renal disease (ESRD) morbidity and mortality, affecting other organs and affecting the overall health of diabetic patients. This study aims to assess the prevalence of diabetic nephropathy and the specific complications of patients with kidney disease.

The study aims to estimate the impact of sugar on kidney patients, with specific objectives including evaluating sugar levels, urea, creatinine, potassium, total sodium, and chlorine levels in diabetic patients. The study also aims to assess the rate of urea, creatinine, potassium, total sodium, and chlorine in diabetic patients.

Materials and Methods:

This study focuses on assessing kidney function in diabetic patients in Tarhona City, Libya. The study is an analytical cross-sectional study, starting from 4-10-2022 and lasting until 6-12-2022. The variables included diabetes duration, gender, and age, as well as independent variables such as sugar, urea, creatinine, potassium, sodium, and chloride.

A total of 130 blood samples were collected by venipuncture and processed immediately after collection. Sugar, urea, and creatinine were measured using a spectrophotometer 4040v5 plus, and the reagent was placed in cuvette tubes labeled as blank, standard, and sample. The results showed that random blood sugar was higher in diabetic patients than the international standard levels of 70-140 mg/dl, creatinine was up to 1.2 mg/dl, and urea was 10-50 mg/dl.

Electrolyte tests were conducted to measure sodium, potassium, and chloride. The results showed that sodium was higher in diabetic patients than the international standard levels of 135-155 mmol/l, potassium was higher than the international standard levels of 3.5-5.5 mmol/l, and chloride was higher than the international standard levels of 95-110 mmol/l.

The study collected data on patients' age, gender, and diabetes duration and evaluated kidney function. The data was analyzed using Microsoft Excel version 2010 and SPSS version 22 statistical packages. Ethical considerations were taken into account, and patients were informed about the study's objectives and asked to sign an agreement.

Results:

The study used a questionnaire form to assess the prevalence of diabetic nephropathy and specific complications in kidney patients. The questionnaire included demographic information and general information about the individuals targeted. Age and gender were analyzed to identify study samples, providing a detailed presentation of their characteristics.

1. Distribution of sample individuals according to age.

Table (1): The repetitive distributions and percentage of the sample individuals on the basis of age:

Age	Frequency	Percent %
Less than 20 years	3	2.31
20 to less than 30	13	10
30 to less than 40	21	16.15
40 to less than 50	17	13.08
50 to less than 60	24	18.46
60 year and more	52	40
Total	130	100

The above table illustrates that 2.31% of the sample were under 20, 10% were between 20-30 years old, 16.15% were between 30-40 years old, 13.08% were between 40-50 years old, 18.46% were between 50-60 years old, and 40% were aged 60 years and above. The majority of the sample was aged between 20 and 60 years.

2. Distribution of sample individuals on the basis of gender:

Table (2): Repetitive distribution and percentage of the sample individuals on the basis of gender:

Gender	Number	Percentage
Male	65	50
Female	65	50
Total	130	100.0

The data set out in the above table, regarding the distribution of the samples of individuals on the basis of gender, was found that 50% of the patients were male, and 50% of the patients were female.

Analysis of some study variables (related to heredity and suffering from some diseases and their treatments)

1. Diabetes in the family:

Table (3): Describes the statistical description for the diabetes mellitus in the family.

		Frequency	Percent
Diabetes Mellitus in the family	no	50	38.5
	yes	80	61.5
	Total		100

From table No. 3, it was found that 38.5% of the respondents had no cases of diabetes in the family, while 61.5% had cases of diabetes in their families.

Suffering from kidney failure:

Table (4): Describes the statistical description for suffering from kidney failure.

		Frequency	Percent
Suffering from kidney failure	no	115	88.5
	yes	15	11.5
	Total	130	100

From Table No. 4, it was revealed that 88.5% of the respondents don't suffer from kidney failure, while 11.5% of them suffer from kidney failure.

Suffering from cardiovascular disease:

Table (5): Describes the statistical description for suffering from cardiovascular disease.

		Frequency	Percent
Suffering from cardiovascular disease	no	122	93.8
	yes	8	6.2
	Total	130	100

From Table No. 5, it was discovered that 93.8% of the respondents don't suffer from cardiovascular disease, while 6.2% of them suffer from cardiovascular disease.

Suffering from high blood pressure:

Table (6): Describes the statistical description for the Suffering from high blood pressure.

		Frequency	Percent
Suffering from high blood pressure	no	86	66.2
	yes	44	33.8
	Total	130	100

From Table No. 6, it was detected that 66.2% of the respondents don't suffer from high blood pressure, while 33.8% of them suffer from high blood pressure.

The complications:

Table (7): Describes the statistical description for the number of complications.

		Frequency	Percent%
The number of complications	no	67	51.5
	yes	63	48.5
	Total	130	100

From Table No. 7, it was found that 51.5% did not suffer from any complications, while 48.5% had complications.

Duration of diabetes:

Table (8): Describes the statistical description for the duration of diabetes.

Duration of diabetes	Frequency	Percent %
1ess than 4 years	42	32.3
From 4 to 8 years	60	46.2
From 9 to 10 years	12	9.2
more than 10 years	16	12.3
total	130	100

Table 8 displays that 32.3% of the sample had a disease duration of less than 4 years, 46.2% had a disease duration ranging from 4 to 8 years, 9.2% had a disease duration ranging from 9 to 10 years, and 12.3% had a disease duration of more than 10 years.

The use of tablets (type I):

Table (9): Describes the statistical description for the use of tablets.

		Frequency	Percent %
Use of tablets	no	103	79.2
	yes	27	20.8
	Total	130	100

From Table No. 9, it was demonstrated that 79.2% of the respondents do not use tablets, while 20.8% of them use tablets (type I).

The use of insulin (type II):

Table (10): Describes the statistical description for the use of insulin.

		Frequency	Percent
Use of Insulin	no	27	20.8
	yes	103	79.2
	Total	130	100

From Table No. 10, it was presented that 20.8% of the respondents do not use insulin, while 79.2% of them use insulin (type II).

Take the medication and follow the instructions:

Table (11): Describes the statistical description for taking the medication regularly and following the instructions.

		Frequency	Percent
Take the medication regularly and follow the instructions	no	7	5.4
	yes	123	94.6
	Total	130	100

From Table No. 11, it was determined that only 5.4% of the respondents are not committed to taking the treatment regularly and do not follow the treatment instructions, while the majority, with a percentage of 94.6%, are committed to taking the treatment continuously and follow the treatment instructions.

Carrying out kidney function checks:

Table (12): Describes the statistical description for carrying out kidney function checks.

		Frequency	Percent
Carrying out kidney function checks	no	65	50
	yes	65	50
	Total	130	100

From Table No. 12, it was obtained that 50% of the respondents regularly perform periodic examinations to monitor kidney function, and on the other hand, 50% of them do not attend this.

Practicing sports activity:

Table (13): Describes the statistical description for the practicing sports activity.

		Frequency	Percent
Practicing sports activity	no	96	73.8
	Some times	26	20
	yes	8	6.2
	Total	130	100

From table No. 13, it was noticed that the majority of the respondents, at a rate of 73.8%, do not persist in practicing sports activity daily, and it was found that 20% of them sometimes practice sports activity, while only 6.2% of the respondents are committed to practicing sports activity daily.

Smoking:

Table (14): Describes the statistical description for the smoking.

		Frequency	Percent
Smoking	no	104	80
	yes	26	20
	Total	130	100

From Table 14, it was found that the majority of the respondents, 80%, were non-smokers, while only 20% of them were smokers.

Pathological analyses:

1. Random Blood Sugar:

Table (15): Describes the statistical description for the random blood sugar.

		Frequency	Percent
Random Blood Sugar	Normal	12	9.2
	abnormal	118	90.8
	Total	130	100

From Table 15, it was showed that the majority of the respondents, with a percentage of 90.8% suffer from diabetes, while 9.2% of them don't suffer from diabetes.

2. Urea:

Table (16): Describes the statistical description for the urea.

		Frequency	Percent
Urea	Normal	108	83.1
	abnormal	22	16.9
	Total	130	100

From Table 16, the majority of the sample, with a percentage of 83.1%, had a normal urea result, while 16.9% of them had an abnormal urea result.

3. Creatinine:

Table no. (17): Describes the statistical description for the Creatinine.

		Frequency	Percent
Creatinine	Normal	25	19.2
	abnormal	105	80.8
	Total	130	100

From Table 17, the majority of the sample, with a percentage of 80.8%, had an abnormal creatinine result, while 19.2% of them had a normal creatinine result.

4. Sodium:

Table (18): Describes the statistical description for the sodium.

		Frequency	Percent
Sodium	Normal	124	95.4
	abnormal	6	4.6
	Total	130	100

From Table 18, the majority of the sample, with a percentage of 95.4%, had a normal sodium analysis, while only 4.6% of them had an abnormal sodium analysis.

5. Potassium:

Table (19): Describes the statistical description for the potassium.

		Frequency	Percent
Potassium	Normal	126	96.9
	abnormal	4	3.1
	Total	130	100

From Table 19, it was revealed that the majority of the sample, with a percentage of 96.9%, had a normal potassium analysis, while only 0.8% of them had an abnormal potassium analysis.

6. Chloride:

Table (20): Describes the statistical description for the chloride.

		Frequency	Percent
chloride	Normal	129	99.2
	abnormal	1	0.8
	Total	130	100

From Table 20, it was found that the majority of the sample, with a percentage of 99.2%, had a normal chloride analysis, while only 0.8% of them had an abnormal chloride analysis.

Figure (20) Repetitive distribution and percentage for the chloride

Effect of sugar on kidney patients:

Table (21): Chi^2 test for the effect of sugar on the kidney.

			Random Blood Sugar		Total	P-value
			normal	abnormal		
Suffering from kidney failure	no	No.	12	103	115	0.189
		percentage	10.4%	89.6%	100.0%	
	yes	No.	0	15	15	
		percentage	0.0%	100.0%	100.0%	
Total		No.	12	118	130	
		percentage	9.2%	90.8%	100.0%	
Chi-Square value calculated = 1.712 df = 1 Chi-Square tabular = 3.84						

P-value <0.05 "Significant", P-value <0.01 "Highly significant", P-value > 0.05 "non-Significant".

From Table No. 21, it was found that the cases of abnormal diabetes analysis were high for those who suffer from kidney failure compared to those who do not suffer from kidney failure, and the P-value is equal to (0.189), which is more than (0.05), which means that there was no effect of sugar on kidney failure.

Effect of urea on kidney patients:

Table (22): Chi^2 test for the effect of urea on the kidney.

			Urea		Total	P-value
			normal	abnormal		
Suffering from kidney failure	no	No.	107	8	115	0.000
		percentage	93%	7%	100.0%	
	yes	No.	1	14	15	
		percentage	6.7%	93.3%	100.0%	
Total		No.	108	22	130	
		percentage	83.1%	16.9%	100.0%	
Chi-Square value calculated = 70.417 df = 1 Chi-Square tabular = 3.84						

P-value <0.05 "Significant", P-value <0.01 "Highly significant", P-value > 0.05 "non-Significant".

From Table No. 22, it was found that the cases of abnormal urea analysis were high for

those who suffer from kidney failure compared to those who don't suffer from kidney failure, and the P-value is equal to (0.000), which is less than (0.05), which means that there was an effect of urea on kidney failure.

Effect of Creatinine on kidney patients:

Table (23): Chi^2 test for the effect of **creatinine** on the kidney.

			Creatinine		Total	P-value
			normal	abnormal		
Suffering from kidney failure	no	No.	11	104	115	0.000
		percentage	9.6%	90.4%	100.0%	
	yes	No.	14	1	15	
		percentage	93.3%	6.7%	100.0%	
Total		No.	25	105	130	
		percentage	19.2%	80.8%	100.0%	
Chi-Square value calculated = 59.946 df = 1 Chi-Square tabular = 3.84						

P-value <0.05 "Significant", P-value <0.01 "Highly significant", P-value > 0.05 "non-Significant".

From Table No. 23, it was found that the cases of abnormal creatinine analysis were low for those who suffer from kidney failure compared to those who don't suffer from kidney failure, and the P-value is equal to (0.000), which is less than (0.05), which means that there was an effect of kidney failure.

Effect of sodium on kidney patients:

Table (24): Chi^2 test for the effect of Sodium on the kidney.

			Sodium		Total	P-value
			normal	abnormal		
Suffering from kidney failure	no	No.	113	2	115	0.000
		percentage	98.3%	1.7%	100.0%	
	yes	No.	11	4	15	
		percentage	73.3%	26.7%	100.0%	
Total		No.	124	6	130	
		percentage	95.4%	4.6%	100.0%	
Chi-Square value calculated = 18.729 df = 1 Chi-Square tabular = 3.84						

P-value <0.05 "Significant", P-value <0.01 "Highly significant", P-value > 0.05 "non-Significant".

From Table No. 24, it was found that the cases of abnormal sodium analysis were high for those who suffer from kidney failure compared to those who don't suffer from kidney failure, and the P-value is equal to (0.000), which is less than (0.05), which means that there was an effect of sodium on kidney failure.

Effect of potassium on kidney patients

Table (25): Chi^2 test for the effect of potassium on the kidney.

			Potassium		Total	P-value
			normal	abnormal		
Suffering from kidney failure	no	No.	115	0	115	0.000
		percentage	100%	0%	100.0%	
	yes	No.	11	4	15	
		percentage	73.3%	26.7%	100.0%	
Total		No.	126	4	130	
		percentage	96.9%	3.1%	100.0%	
Chi-Square value calculated = 31.64 df = 1 Chi-Square tabular = 3.84						

P-value <0.05 "Significant", P-value <0.01 "Highly significant", P-value > 0.05 "non-Significant".

From Table No. 25, it was found that all cases of abnormal potassium analysis suffered from kidney failure, and the P-value is equal to (0.000), which is less than (0.05), which means that there was an effect of potassium on kidney failure.

Effect of chloride on the kidney patients:

Table (26): Chi^2 test for the effect of chloride on the kidney.

			Chloride		Total	P-value
			normal	abnormal		
Suffering from kidney failure	no	No.	114	1	115	0.717
		percentage	99.1%	0.9%	100.0%	
	yes	No.	15	0	15	
		percentage	100.0%	0%	100.0%	
Total		No.	129	1	130	
		percentage	99.2%	0.8%	100.0%	
Chi-Square value calculated = 0.131			df = 1		Chi-Square tabular = 3.84	

P-value <0.05 "Significant", P-value <0.01 "Highly significant", P-value > 0.05 "non-Significant".

From Table No. 26, it was found that the cases of normal chloride analysis were high for those who do not suffer from kidney failure compared to those who suffer from kidney failure, and the P-value is equal to (0.717), which is more than (0.05), which means that there was no effect of chloride on the kidney.

Discussion:

This study concerns evaluating the kidney function of diabetic patients and comparing it with the existing study variables (age, gender, family history, hypertension, insufficiency, or kidney failure, cardiovascular disease, duration of injury, treatment, kidney function tests, sports activity, and smoking). There were 130 patients in this research, 50% of whom were male and 50% female. In this study, the number of females was equal to the number of males. These results disagreed with the previous study in Egypt (Elnajjar et al., 2016). Data from our study also indicated that the age of patients varies from less than 20 years to more than 60 years. The highest prevalence of the disease is found in the older age group (60 and over) for both sexes. These results are similar to the previous study in Nepal (Pakhrin et al., 2020). In the current study, 46.2% of the total male and female patients developed this disease within 4 to 8 years. It was also found in our results that 38.5% of the respondents do not have diabetes cases in the family, while 61.5% have diabetes cases in their families, and these results disagree with what was mentioned (Joshi et al., 2023). The prevalence of diabetes tends to be higher among people with high blood pressure. But in this study, we found that the relationship between hypertension and diabetes is insignificant; this result disagrees with those (El-Hazmi & Warsi, 2001). We also found that most of the respondents, about 80%, were non-smokers, while only 20% of them were smokers, and this is similar to what he mentioned (Nazzal et al., 2020). Taking one reading in one place is usually not conclusive for the state of blood pressure (Jame et al., 2014). It showed that 80.8% of patients with type I and II diabetes had raised serum creatinine (> 1.2 mg/dl), 16.9% of patients had raised serum urea (> 50 mg/dl), 4.6% of patients had raised serum sodium (> 155 mmol/l), 1% of patients had raised serum potassium (> 5.5 mmol/l), and 0.8% of patients had raised serum chloride (> 110 mmol/l). In this study, the percentage of creatinine was the highest, with a percentage of 80.8, and these results disagree with the study in India (Padda et al., 2018). The reason for the difference in serum creatinine levels may be due to factors such as different weights, dehydration, or taking creatinine supplements. The reason for the difference in serum creatinine levels may be due to factors such as different weights, dehydration, or taking creatinine supplements. The sodium, potassium, and chloride levels of the researchers in our study were mostly normal. In our results, we found that 79.2% of respondents do not use tablets, while 20.8% of them do. It was also found that 20.8% of

respondents do not use insulin, while 79.2% of them do. On the other hand, it was found that only 5.4% of respondents are not committed to taking the remedy regularly and do not follow the treatment instructions, while the majority, at 94.6%, are committed to taking it. The remedy is continuous and follows the treatment instructions. In our study, renal failure affected 15 participants out of 130 participants enrolled in the study; 8 patients had cardiovascular diseases, and 44 patients had hypertension. These findings didn't agree with our study (Cheema et al., 2018).

Conclusion:

The study concluded that diabetes did not have a significant effect on renal failure in the research sample, with a P-value of 0.189. The majority of the sample had diabetes in the family, with 11.5% experiencing renal failure and 6.2% having cardiovascular disease. High blood pressure was the most common issue, with 33.8% of the sample having complications. The majority of the sample used diabetes medication tablets, with 79.2% using insulin. The study also revealed that 90.8% of the participants had abnormal blood sugar, urea, creatinine, sodium, potassium, and chloride analyses. The percentage of those with abnormal urea and creatinine was 16.9%, while the percentage of those with abnormal sodium was 4.6%, potassium 3.1%, and chloride 0.8%. The study highlights the importance of understanding the impact of diabetes on renal failure and other health outcomes in the population.

Recommendations:

Upon the results of this study, it's highly recommended to: The study suggests that further research is needed to strengthen the link between sex and diabetic nephropathy. It also suggests that future research should use standardized criteria for defining ESRD and the population at risk. Further research is needed to determine the efficacy of current interventions, particularly among individuals with kidney failure. The study also suggests that further research is needed to determine the causes of observed increases and decreases in CKD incidence and identify potential disparities between age groups. The study emphasizes the need for novel approaches to prevent renal deterioration and suggests that the government and pharmaceutical companies should help in this field. The study recommends taking diabetes medication, conducting periodic kidney function checks using a chemistry device, and engaging in regular sports activities to prevent renal insufficiency and maintain kidney function.

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