مجلة الدراسات التربوية والعلمية - كلية التربية - الجامعة العراقية
العدد السادس والعشرون - المجلد الثاني - علوم الحياة - تشرين أول 2025 م
doi.org/10.52866/esj.2025.02.26.09

# Estimation of kidney function by assessing serum creatinine levels and glomerular filtration rate in a sample of elderly diabetic patients in Babylon

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**Abstract :**

Creatinine is a waste product produced via the catabolism of phosphocreatine in muscle that is used as an energy source; it's filtered mainly by the kidneys, although a small amount is actively secreted. So it's used as an indicator of renal function; the study aims to investigate serum creatinine and GFR in diabetic and non-diabetic elderly people in Babylon province. The study was performed in the laboratories of the diabetic center in the Marjan Medical Teaching City. The study included 60 subjects, divided into 20 healthy < 40 years old, 20 non-diabetic subjects>50 years old, and 20 diabetic subjects>50 years old. For all three groups, the random blood glucose, creatinine, and GFR were measured. The **results** show a significant increase in serum creatinine and GFR in the diabetic > 50 years, and there was a positive correlation between serum creatinine and glucose in the diabetic >50 years. Additionally, there was a positive correlation between serum creatinine and age in both diabetic and non-diabetic > 50 years, and the change in GFR of the diabetic > 50 years old group was greater than other study groups.

The study **concluded** that aging and poor glycemic control are associated with impaired renal function, as reflected by elevated serum creatinine and reduced eGFR

**Key words**: Creatinine, random blood glucose, glomerular filtration rate (GFR), diabetic .

## تقدير وظائف الكلى من خلال تقييم مستويات الكرياتينين في المصل ومعدل الترشيح الكبيبي لعينة من المصابين بداء السكر كبار السن في محافظة بابل

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**مستخلص:**

الكرياتينين هو مركب ايضي ناتج عن استقلاب فوسفوكرياتين في العضلات، ويُستخدم كمصدر للطاقة؛ ويتم ترشيحه بشكل رئيسي عن طريق الكلى، على الرغم من إفراز كمية صغيرة منه بنشاط. لذا، يُستخدم كمؤشر على وظائف الكلى. تهدف هذه الدراسة إلى دراسة مستوى الكرياتينين في المصل ومعدل الترشيح الكبيبي لدى كبار السن المصابين بالسكري وغير المصابين به في محافظة بابل. أُجريت الدراسة في مختبرات مركز السكري بمدينة مرجان الطبية التعليمية. شملت الدراسة 60 شخصًا، مقسمين إلى 20 شخصًا سليمًا أعمارهم أقل من 40 عامًا، و20 شخصًا غير مصاب بالسكري أعمارهم أكبر من 50 عامًا، و20 شخصًا مصابًا بالسكري أعمارهم أكبر من 50 عامًا. في جميع مجموعات الدراسة، تم قياس مستوى السكر في الدم والكرياتينين ومعدل الترشيح الكبيبي بشكل عشوائي لجميع المجموعات الثلاث.

أظهرت **النتائج** ارتفاعًا ملحوظًا في كرياتينين المصل ومعدل الترشيح الكبيبي لدى مرضى السكري الذين تزيد أعمارهم عن 50 عامًا، كما وُجد ارتباط إيجابي بين كرياتينين المصل والجلوكوز لدى مرضى السكري الذين تزيد أعمارهم عن 50 عامًا، بالإضافة إلى ارتباط إيجابي بين كرياتينين المصل والعمر لدى كلٍّ من مرضى السكري وغير المصابين به، وكان التغير في معدل الترشيح الكبيبي لدى مرضى السكري الذين تزيد أعمارهم عن 50 عامًا أكبر من مجموعات الدراسة الأخرى. وخلصت الدراسة إلى وجود علاقة بين مستوى الكرياتينين ومستوى سكر الدم غير المنضبط، وكذلك بين كرياتينين المصل والعمر، وخاصةً لمن تزيد أعمارهم عن 50 عامًا.

**الكلمات المفتاحية**: الكرياتينين، كلوكوز الدم، معدل الترشيح الكبيبي، مرضى السكر، كبار السن .

## Introduction

Creatinine is produced endogenously within the body and is freely filtered by the glomerulus. These characteristics make creatinine a useful endogenous marker for creatinine clearance [1, 2]. Plasma creatinine concentration is a function of muscle mass, the rate of creatine turnover, and renal function. The amount of creatinine in the bloodstream is reasonably stable, although the protein content of the diet does influence the plasma concentration [3,4].

The term diabetes mellitus describes a metabolic disorder of multiple etiology characterized by chronic high blood glucose (hyperglycaemia) with disturbances of carbohydrate, fat and protein metabolism resulting from defects in body either does not produce enough insulin (insulin secretion), is unable to use its insulin (insulin action), or both, [5,6].

Glomerular filtration rate (GFR) is the best measure of kidney function since it accounts for age, BMI, and sex. GFR measures the rate of plasma filtration in order to process it and remove waste products from it. If the kidneys are injured by chronic kidney disease, the GFR gradually declines, and the amount of remaining kidney function can be estimated by measuring or calculating the GFR [7,8,9].

The study **aims** to estimate the change in serum creatinine and GFR in patients with type 2 diabetes, >50 years old, and non-diabetic, > 50 years old.

**Patients and Methods**

A case-control study was carried out on patients who attended the diabetic and endocrinology center and registered in the center as type 2 diabetic mellitus patients (DM) group, Marjan Medical Teaching City in Babylon Governorate in Hilla city.

Samples in the present study were collected from January to April 2025. The current study was carried out at the laboratories of the diabetic center in the Marjan Medical Teaching City.

A Total of 60 subject participants were enrolled and classified into three groups. These subjects were divided into three groups;

The **first** group included 20 males with elderly diabetes mellitus > 50 years old,

The **second** group included 20 males without elderly diabetes mellitus,> 50 years old, and

The **third** group included healthy males less than 50 years old.

**Exclusion criteria**: Any participant suffering from the following was excluded from the study:

- Hypertension, Kidney problems, Liver disease, jaundice, and Obesity.

A questionnaire of each patient was taken, which included: age, duration of diabetes mellitus, types of antidiabetic treatment, blood pressure, and family history of diabetes.

: BMI = weight (kg) / height² (m²)

Only individuals with normal (18.5–24.9) or overweight (25–29.9) BMI values were included.

**Blood samples**

Five milliliters of venous blood were obtained by antecubital venipuncture using a needle between 8:30-12:00 AM for random samples. The blood was allowed to clot at room temperature; the serum was aspirated after centrifugation at 4500 rpm for 10 min. the serum used for random blood glucose and serum creatinine laboratory measurements [10].

**Serum glucose measurement**

The glucose kit is used for quantitative colorimetric determination of glucose in serum and was supplied by Fujifilm Laboratory (Japan) [10].

**Serum creatinine measurement**

Creatinine kit is used for quantitative colorimetric determination of glucose in serum and was supplied by Fujifilm Laboratory –Japan [10]..

**Glomerular filtration rate equation:**

GFR= 186.3 x Serum Creatinine $^{(-1.154)}$ x Age $^{(-0.203)}$

**GFR values can be classified as follows:**

- Normal: 100-140 mL/min,
- Mild Kidney Failure < 90 mL/min,
- Moderate Kidney Failure < 60mls/min,
- Severe Kidney Failure < 30 mL/min, and
- End-stage Kidney Failure < 15 mls/min, **[11]..**
- **Measurements:** By using the formula: BMI = weight (kg) / height² (m²). Only individuals with normal (18.5–24.9) or overweight (25–29.9) BMI values were included.

**Statistical Analysis**

The analyses were performed using the statistical package for social sciences (SPSS version 21.0). The data was expressed as mean ± S.D. ANOVA assessed statistical significance;

*P values* of less (*0.05* were considered significant.

**Result**

The mean ±SD age for participants.

For the diabetic group mean ±SD was 57.6 ± 6.3 years and for the non-diabetic group was 56.5 ± 5.9, and for the normal health group was 45.2 ± 1.5 years. **Figure** (1) compare the level of random blood glucose among control (105.6 ± ١١mg/ dl), non-diabetic > 50 y (113.8 ± ١٠ mg/dl), and Diabetic > 50 y groups (148.3 ± 9.2 mg/dl), Diabetic >50 y increased significantly at *P < 0.05* in random levels between these subtypes.

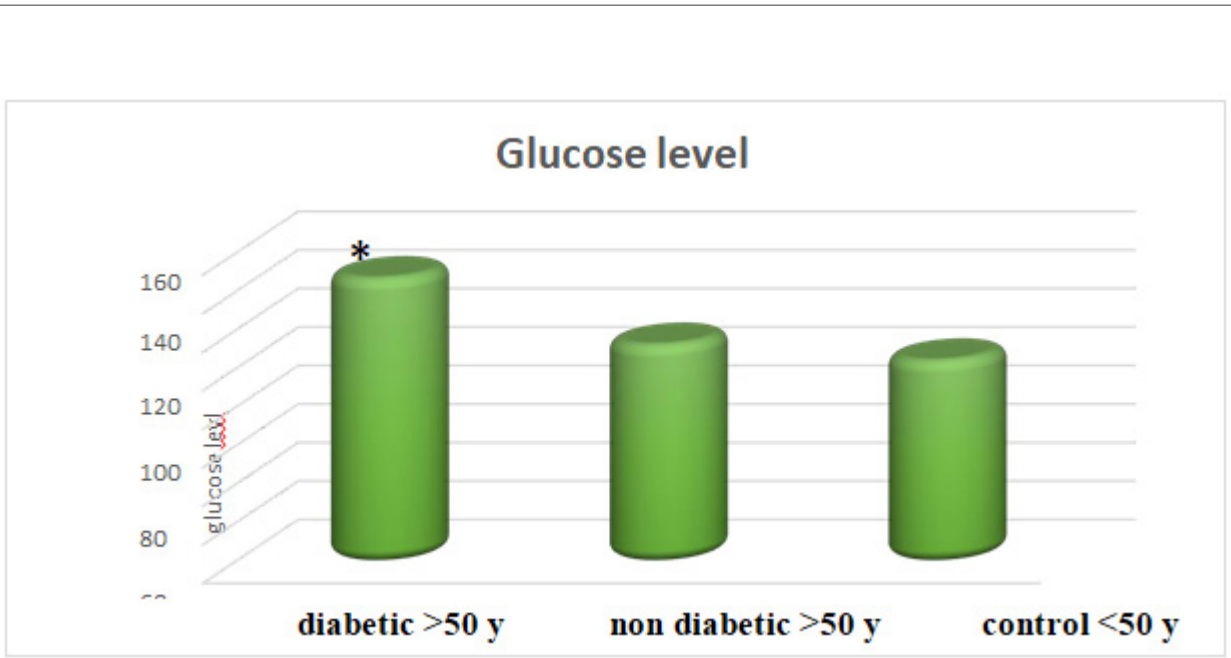


**Figure (1):** Random blood glucose in the control and T2DM study group

**Results showed in Figure (2)** the percent of serum glucose in diabetic >50 y group, where there are 13 (65%) subject had high abnormal glucose level (> 140 mg/ dl), 4 (20%) subject had normal serum glucose (borderline) (>120 mg/dl), and 3 (15%) had normal glucose level.

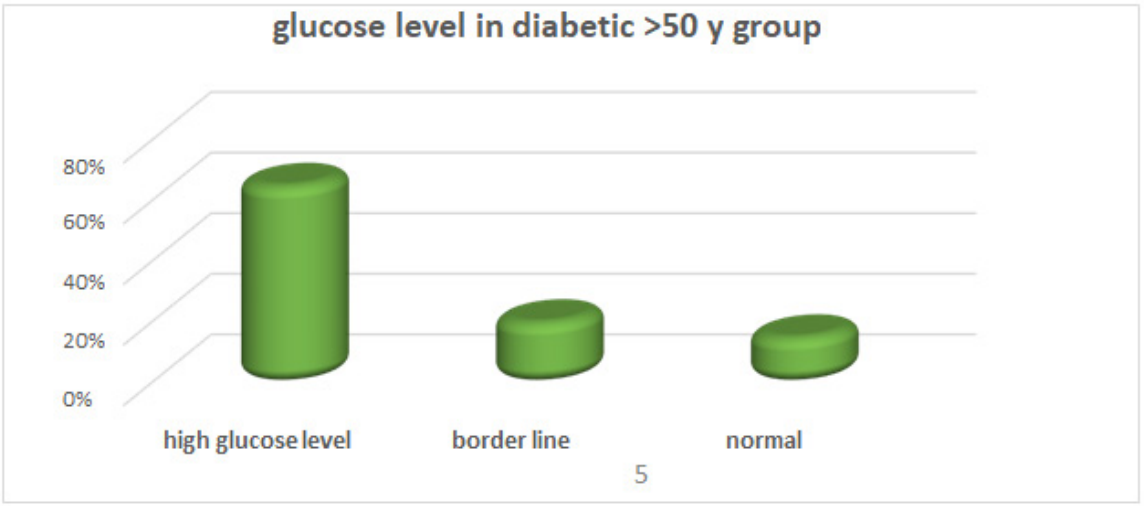


**Figure (2): Random blood glucose in diabetic >50 y group**

**While Figure (3)** show creatinine level, to compare the level of creatinine level among control (0.81 mg/ dl), non- diabetic > 50 y (0.95 ± 0.1 mg/dl) and Diabetic > 50 y groups (1.14 ± 0.2 mg/dl), Diabetic >50 y increased significantly at $P < 0.05$ in random levels.

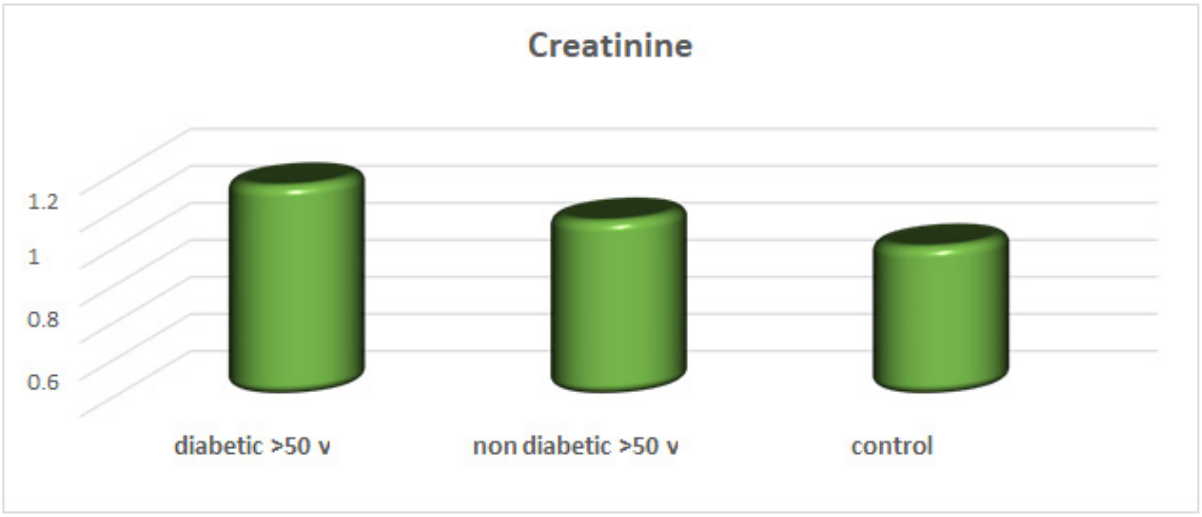


**Figure (3): serum creatinine level in control and T2DM patients**

**Table 1** shows the mean difference in creatinine level between study groups (A nova test), where there is a significant difference in serum creatinine level between the diabetic > 50 y group and the non-diabetic > 50 y group, respectively.

Also, the present finding shows a correlation between serum creatinine and random blood glucose in the study group, where there is a significant correlation in serum creatinine and glucose in the study group (r=0.35; *p≤0.01).*

**Table 1: Difference in creatinine level between study groups**

| Dependent Variable | Groups | groups | Mean Difference e | *P. Value* |
|---|---|---|---|---|
| Creatinine | Diabetic >50 y | Non Diabetic >50 y | .188* | .003 |
| | | Control | .347* | .000 |
| | Non Diabetic >50 y | Diabetic >50 y | -.188* | .003 |
| | | control | .158* | .012 |
| | Control | Diabetic >50 y | -.347* | .000 |
| | | Non Diabetic >50 y | -.158* | .012 |

**Correlation results**

**Figure 4)** shows the correlation between serum creatinine and age in the diabetic > 50 y group. There is a significant correlation (positive relation) between serum creatinine and age (linear = 0.216) in the diabetic > 50-year group.

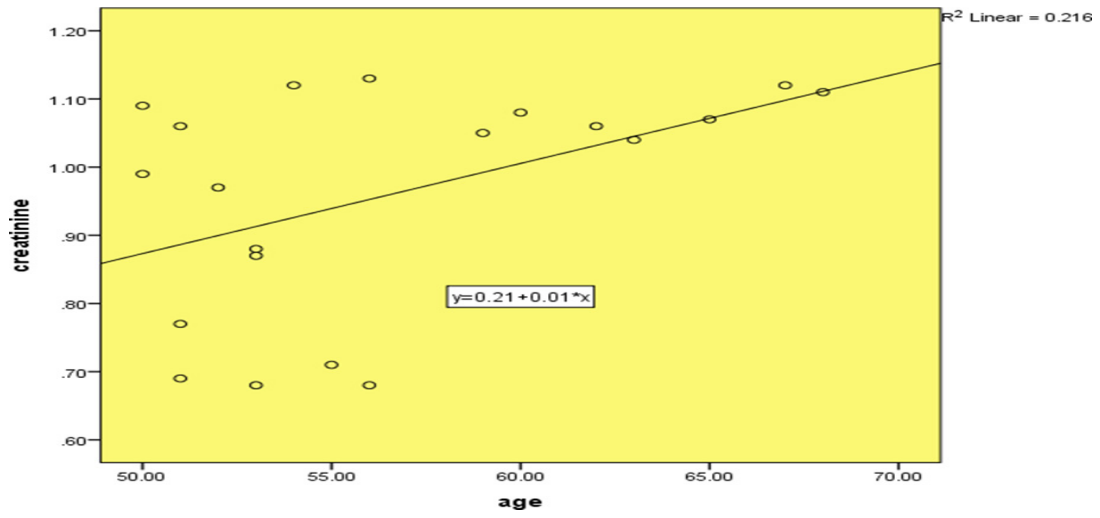


**Figure (4): Pearson correlation between serum creatinine and age in the diabetic50< y group.**

**Figure 5)** shows the correlation between serum creatinine and age in the non-diabetic >50 y group. There is a significant correlation (positive relation) between serum creatinine and age (linear = 0.168) in the non-diabetic > 50 y group.

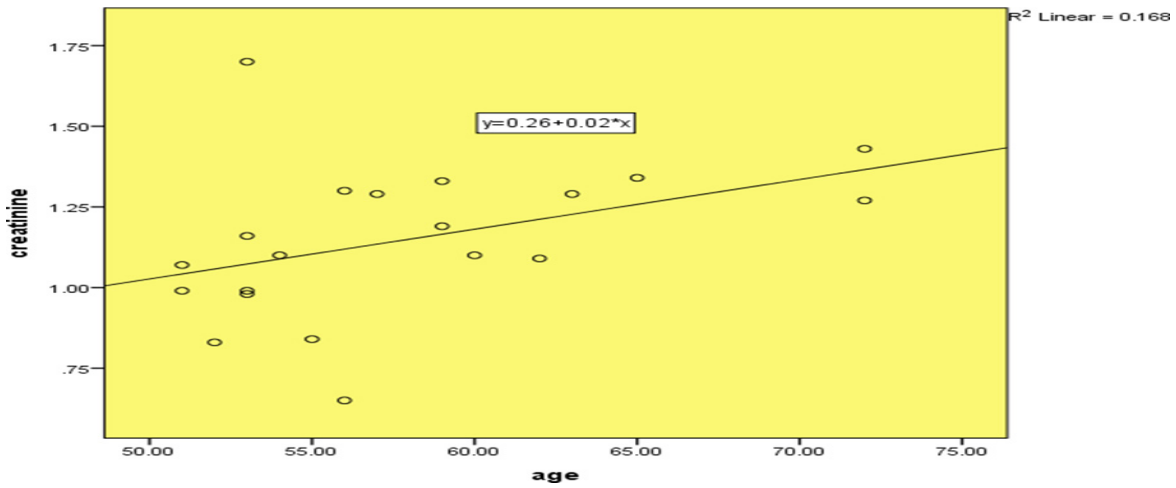


**Figure (5): Pearson correlation between serum creatinine and age in non- diabetic >50 y group.**

**Glomerular filtration rate results**

**Figure (6)** compare the value of GFR among control (119 ± 7 mL/min), non-diabetic > 50 y (89 ± 11 mL/min) and Diabetic > 50 y groups (73 ± 8 mL/min), Diabetic >50 y increased significantly at $P < 0.05$ in random levels between these subtypes.


**Figure (6): Glomerular filtration rate value**

## Discussion

In the present study, T2 diabetic mellitus patients have a significant elevation in blood sugar compared with normal healthy controls. This finding agrees with previous results (5,6). This result confirms that T2DM patients suffer from uncontrolled DM [8,9].

The higher creatinine levels in diabetics might reflect impaired kidney function, as elevated serum creatinine is a common marker of renal impairment. This aligns with known complications of diabetes affecting renal health.

The significant differences between non-diabetics over 50 and the control group suggest that aging alone may also contribute to increased creatinine levels, although to a lesser extent.

The results emphasize the importance of monitoring kidney function in both diabetic and non-diabetic elderly populations.

Chronic kidney disease (CKD) affects about 50% of patients with T2DM. Diabetic nephropathy is the most common clinical condition of diabetic patients with progressive deterioration of renal function in T2DM [11]..

The present study found that where there is a significant difference in serum creatinine level between the diabetic > 50 y group and the non-diabetic > 50 y group, the control respectively. The present study agree with previous study found an elevation in serum creatitine in DM type II patients, [12,13,14].

The present study found that a positive correlation exists between serum creatinine and age in the diabetic > 50 y group. Glomerular filtration rate (GFR) declines by about 8 ml/min/1.73 $m^2$ per decade in normal status regarding metabolic disease [13].

A previous study found that the serum creatinine concentration increased steadily with advance on age, in both men and women from the age of 40 years and 60 years [14].

Thus, both diminished glomerular lobulation and sclerosis of glomeruli tend to reduce the surface area available for filtration, and therefore contribute to the observed age-related decline in GFR [15].

On the other hand, a previous study done on 207 diabetes patients for more than 5 years, the study found that a low serum creatinine was associated with increased risk of renal complications

in T2 diabetes mellitus [16].

**Conclusions;**

Overall, this analysis highlights significant differences in creatinine levels among the studied groups, underscoring the impact of diabetes and aging on renal function. These findings reinforce the need for routine renal monitoring in diabetic and elderly populations to facilitate early detection and management of potential kidney issues.

Increase serum creatinine with age, Diabetic complications, especially nephropathy, increase serum creatinine by decreasing GFR, and a decrease in GFR continuousLy.

**Recommendation ;**

Monitor serum creatinine annually for people > 50 years old and monitor every 6 months for people with diabetes>50 years old.

**Acknowledgment:** The authors of this study thank Prof. Dr. Mousa M. Marbut from Al-Farabi University for suggesting the study, help, and encouragements for the whole study.

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