

DIAGNOSTIC ASSESSMENT OF RENAL FUNCTION TESTS (RFTS) AND EGFR IN DIABETIC PATIENTS OF FAISALABAD, PUNJAB, PAKISTAN

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Abstract

The objective of this research was to evaluate Renal Function Tests (RFTs) in diabetic patients in Faisalabad, Punjab, Pakistan, and to find out factors related to renal dysfunction. The study was a cross-sectional analytical study that was done among 200 diabetic patients who were divided in three hospitals in Faisalabad that were selected using systematic random sampling. Serum creatinine, estimated glomerular filtration rate (eGFR), and Random Blood Sugar (RBS) were assessed by use of standard biochemical techniques and demographic and clinical information were obtained by using structured questionnaires. The results indicated that renal impairment was high and a good percentage of patients had high values of serum creatinine and eGFR. The longer patients had diabetes, the worse was the renal functioning. The same was strongly correlated with the higher the levels of RBS. Patients who did not adhere to medications and lacked awareness about diabetic kidney disease exhibited more severe cases of renal abnormalities, and older patients and those with long-lasting disease duration exhibited the best rates of renal dysfunction. In general, the article demonstrates that the renal impairment is very common among diabetic patients in Faisalabad, and more frequent renal checks, early diagnosis, and subsequent treatment are essential. Enhancement of screening procedures, improving patient education and use of uniform diagnostic guidelines in all healthcare institutions are essential in lowering the incidence of diabetic kidney disease in the area.

INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorders characterized by abnormally high blood glucose levels caused either by inadequate insulin production or the body's inability to respond properly to insulin. The common symptoms include increased urination (polyuria), excessive thirst (polydipsia), and heightened hunger (polyphagia). Diabetes is generally divided into three types: **Type 1 DM**, an insulin-dependent form in which the body fails to produce insulin and patients must use insulin

therapy; **Type 2 DM**, a non-insulin-dependent form associated with insulin resistance or reduced insulin secretion, historically known as adult-onset diabetes; and **gestational diabetes**, which occurs during pregnancy in women without a prior history of diabetes and may lead to the future development of Type 2 DM (Zhang et al., 2020).

Type 2 diabetes mellitus is a fast-growing health issue in the world with population growth increasing rapidly, aging, urbanization and rising occurrence of

obesity and physical inactivity. Diabetes and its complications, therefore, must be prevented at all costs. Diabetes ranks as the largest underlying cause of end-stage renal disease (ESRD) in the U.S., and globally, and is associated with such immense medical, social and economic impact. The kidney is impacted by diabetes in phases. When diabetes is first developed, the kidney becomes enlarged and the glomerular filtration rate (GFR) is disrupted. The recent fundamental and clinical studies have indicated kidney failure and sclerosis. Chronic complications like diabetic mellitus can be treated, identified in good time and consequently the morbidity and mortality can be minimized through screening and early detection of chronic complications and their treatment. This discussion will therefore be dealt with regard to development of kidney damage, the different markers that could be utilized, and the different methods that could be used to develop future markers to increase the detection of ESRD at the earliest stage possible (Tsuda et al., 2022).

Kidneys play a very vital role in excretion of waste products and toxins like urea, creatinine and uric acid. Renal function is significant in the treatment of patients with kidney disease or any other illness, which influences the renal functioning. Renal Function Tests (RFTs) play a significant role in detecting the presence of kidney disease, the rate at which the kidneys are healing and in the progression of the disease. But glomerular filtration rate (GFR) which can be defined as a measured glomerular filtration rate, is a better measurement of renal function (eGFR). C is equal to UV / P , w (Becker & Friedman, 2023). Most of the waste nitrogen is excreted by the kidney. Most of this urea is synthesized in the liver as an end product of the protein metabolism. Most of the nitrogen waste discharged through excretion consists of small molecules such as urea (Fenton, A.2020). Urea, the primary nitrogenous metabolic waste, is formed upon the breakdown of the proteins (Ghaderian & Beladi-Mousavi, 2025). Urea is the primary nitrogenous metabolic by-product of protein breakdown.

Serum Creatinine is most common test used as the sole indicator of renal function; however, the serum level also reflects creatinine production, ingestion,

and metabolism. To calculate eGFR and progress, it is crucial to use more precise, sensitive measures of renal function. Although eating meat may also have a small impact, the production of creatinine is almost entirely dependent on the metabolism of creatine. w_2 w_3 the daily variability of serum creatinine levels in people with steady renal function is typically only 8%. w_4 w_5 Kidney illness in children is significantly influenced by uric acid, a weak organic acid that is freely filtered at the glomerulus. Kidney illness in children is significantly influenced by uric acid, a weak organic acid. Up to 15% is frequently secreted by the tubules, but it is not reabsorbed (Higgins, 2022).

The signs of a renal function test measure how well the kidneys are working normally. The standard markers for analysis are creatinine, urea, uric acid, and electrolytes. The relationships between type 2 diabetic patients' diabetic retinopathy (DR) and renal capability. Among Chinese type 2 diabetics, a substantial correlation exists between increasing DR severity and decreased renal functioning with increased risk of lower kidney function and a higher chance of developing CKD. These relationships are unrelated to CKD risk variables, indicating that measuring DR may provide important details about renal function and the likelihood of developing kidney disease (Shihas et al., 2025).

The significant cause of renal dysfunction resulting in chronic kidney disease (CKD) is diabetes, which causes renal failure to be of great importance in the evaluation of kidney functions. The estimation of Glomerular Filtration Rate (GFR) through serum creatinine is not important, and it relies on the digestive absorption and synthesis of creatinine in muscles and its tubular secretions, Formulas have been established to estimate Glomerular Filtration rate using serum creatinine and proteinuria, but the wide distribution of GFR Makes the errors of such estimations a great concern to the diabetic patients (Sapkota et al., 2021). The most frequently used and generally recommended equations are simple Cockcroft-Gault equation, not actually accurate, also being biased because it is a measurement of clearance of creatinine in relation to body weight, and the other one is the MDRD equation, which is somewhat more accurate but also tends to underestimate normal and high GFR as it is a

statistical analysis of results with patients having renal-insufficiency (Imtiaz & Alam, 2023).

Diabetes is the most frequent cause of the kidney failure which is cause of almost 44 % of new cases. The disease may result in chronic kidney disease (CKD) and kidney failure even with the controlled state of diabetes. The last stage of chronic kidney disease is the kidney failure. In the United States, there are almost 24 million diabetic persons and almost 180 000 individuals are living with kidney failure due to diabetes. Nephropathy had lower prevalence in India (8.9 in Vellore, 5.5 in Chennai) compared to the prevalence rate of 22.3% in the Asian Indians in the UK. The pre-eminence of diabetic nephropathy was 30.3, 23, and 17.7 in chronic renal failure patients respectively and is preceded by chronic renal failure (17.7%) (Fufaa et al., 2024).

MATERIAL AND METHODS:

It was a Case-Control study (Rohitash, et al., 2014). carried out in MTH (Madina teaching hospital) Faisalabad, and the number of the participants was 300. The sample study included 200 clinical established patients with Type 2 Diabetes Mellitus (T2DM) (the Cases) and 100 healthy normal patients (the Controls) of either sex and of different ages. Blood samples of all the subjects were taken after an overnight fast into fluoride tubes (to determine the blood glucose level) and plain tubes (to determine other parameters). Serum was centrifuged and after that, it was analyzed. Some of the estimated parameters were: FBS and PPBS (analyzed through the GOD-POD method), Serum Urea (by the Enzymatic Urease Method), Serum Creatinine (by the Jaffe's or enzymatic method, referred as the s method), and Serum Uric Acid (by the enzymatic method). The Clinical Biochemistry laboratory did all its biochemical analyses on semiauto-analyzers and auto-analyzers using commercially available reagents and kits. eGFR was not directly measured but

calculated in all subjects that used the existing Cockcroft-Gault equation.

$$eGFR = \frac{(140 - \text{age}) \times \text{body-weight}}{72} \times \text{serum-creatinine}$$

creatinine

Statistical Analysis

Lastly, the results obtained were statistically compared by processing an independent t -test to determine the difference between mean values of the Cases and the Controls. (Ghaderian & Beladi-Mousavi, 2025).

RESULTS:

The study has demonstrated the existence of very significant difference of all estimated parameters between the 200 cases (Type 2 DM patients) and the 100 normal controls. According to the extremely high disparities in all the parameters measured, the 200 Case patients are clinically assumed to have developed and poorly managed Type 2 Diabetes Mellitus (T2DM).

Uric acid

The mean value was significantly higher in Cases 5.01 ± 0.78 mg/dl) than in Controls 4.07 ± 0.68 mg/dl) with the highest significance $p < 0.0001$ with t value 4.57 as shown in **Table 1** and **Figure 2**.

Serum urea

The Mean serum urea result was 34.08 ± 9.62 mg/dL in controls and 25.80 ± 6.75 mg/dl) in cases. This was a very significant difference ($p < 0.0010$) as shown in **Table 1**.

Creatinine level:

The mean was found to be significant in Cases (1.43 ± 1.73 m) than Controls (80.08 ± 1.73 m²) (p value 0.0002) and t value =4.06 as shown in **Table 1**.

eGFR:

The mean was observed to be significantly smaller in Cases (60.62 ± 1.73 m) than in Controls (80.08 ± 1.73 m²) as shown in **Table 1** and **Figure 2**.

Table No. 1: Mean values of parameters of cases and controls

Parameters	Cases (n=200) Mean $\pm$ SD	Controls (n=100) Mean $\pm$ SD	p-value
FBS	189.40 ± 36.90	95.44 ± 13.38	<0.001*

Parameters	Cases (n=200) Mean $\pm$ SD	Controls (n=100) Mean $\pm$ SD	p-value
PPBS mg/dl)	232.24 $\pm$ 41.17	132.56 $\pm$ pm 9.56	<0.0001*
Urea mg/dl)	34.08 $\pm$ 9.62	25.80 $\pm$ 6.75	0.0010*
Creatinine mg/dl)	1.43 $\pm$ 0.40	1.05 $\pm$ 0.24	0.0002*
URIC ACID mg/dl)	5.01 $\pm$ 0.78	4.07 $\pm$ 0.68	<0.0001*
eGFR(ml/min./1.73m2)	60.62 $\pm$ 16.05	80.08 19.94	0.0004*

*significant

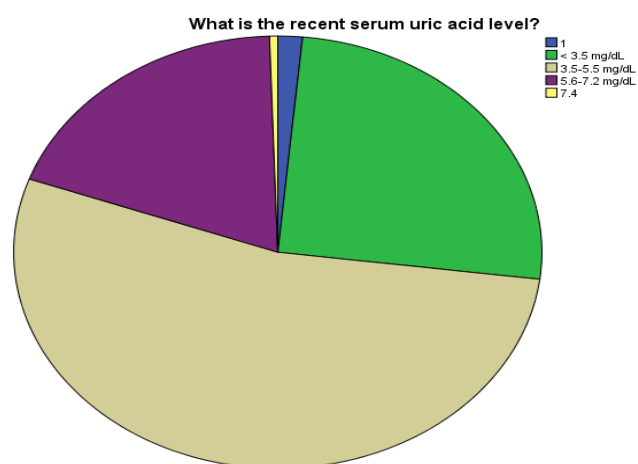


Fig-1: The Mean serum uric acid levels

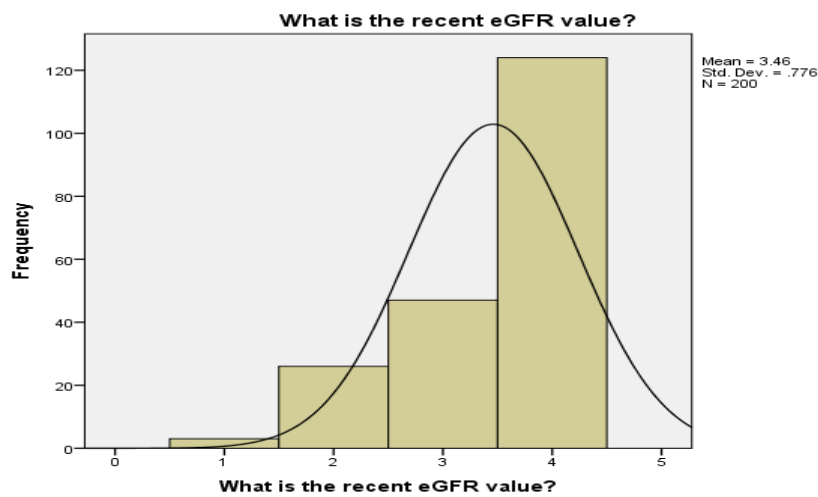


Fig-2: The Mean eGFR levels

Correlation between Blood Sugar and eGFR

The research showed that both the Fasting Blood Sugar (FBS) and the Post-Prandial Blood Sugar (PPBS) had a significant positive relationship with

Table 2: Correlation between Blood Sugar and eGFR

Blood Sugar Parameter	p-value for Correlation with eGFR	Result
FBS	p=0.006	Significant Positive Correlation
PPBS	p=0.04	Significant Positive Correlation

the Estimated Glomerular Filtration Rate (eGFR) in the cases and the controls as shown in (Table 2).

Discussion:

The results of this study offer a multi-dimensional and broad insight in the nature of renal functioning in diabetic cases living in Faisalabad which is a large city and industrial hub of the Punjab region of Pakistan. The comparison of biochemical indicators of a 200 diabetics population involving serum creatinine, serum urea, uric acid, and estimated glomerular filtration rate (eGFR) has provided valuable data on the prevalence, degree and potential causes of renal failure in this region. Collectively, these results indicate a trend of extensive renal impairment that seems to be much more complex in the high-risk groups of Pakistan but is aligned with the findings of the study on diabetic nephropathy in the world. The research, in its turn, provides substantial additional information on the local incidence of diabetic kidney disease and indicates the necessity of more sophisticated screening and treatment processes (Umar et al., 2022).

Family history of diabetes was frequent among individuals, further strengthening the genetic and family clustering of diabetes in Pakistan. South Asians are more likely to develop diabetic nephropathy due to a genetic tendency to insulin resistance, visceral fat buildup, and early beta-cell failure. Families frequently have similar diets, which might exacerbate glycemic levels. Examples of these diets include excessive carbohydrate intake, sweet beverages, fried foods, and poor fiber consumption.

The powerful family history indicates that there are poor awareness and preventive measures in houses as well. Most families may also normalize the symptoms of diabetes because of their experience with the condition instead of encouraging early screening. This may lead to failure to detect and intervene early enough and this ultimately increases the chances of kidney damage before the medical attention is obtained (Dabla, 2022).

Among the most shocking conclusions of the study is the status of significantly bad levels of glycemic control of the subjects. Random sugar readings indicated a great range with a high average meaning that most people were well above the normal levels of glucose levels. Long-lasting hyperglycemia is a direct cause of harm to the kidneys. It not only makes the glomerular basement membrane thicker, increases intraglomerular pressure, but also initiates inflammatory mechanisms which ultimately lead to scarring of kidneys along with reduced filtration. The large deviation in the blood sugar scores further indicate that she has irregular medication, inadequate compliance to the diabetic diets, maybe over- or under-insulin treatment, or not self-monitored. In the current scenario of Faisalabad, the symptomatic relief is the relocation applied by many patients, not based on follow-up, and only appear to the doctor when they are tired, if edema, or abnormal urine presents itself. The effect of this habit is undue and chronic uncontrolled diabetes that results in high risk of renal damage (Gounden et al., 2024).

Uric acid levels in serum showed the moderate increase in a large percentage of the population.

Hyperuricemia is a known risk factor of CKD development as well as accelerated CKD progression. Uric acid crystals may result in functioning of oxidative stress, hindering endothelial functioning and mounting within renal tubules. High uric acid is also associated with hypertension that is the leading cause of diabetic nephropathy. The renal damage may still be observed even in patients with normal levels of uric acid but high levels of creatinine, however, the fact that some participants had hyperuricemia suggests extra metabolic loads that can increase the adverse outcomes of renal dysfunction. This tendency has highlighted the importance of the holistic approach to the management of diabetes in which kidney health now is investigated together with the metabolic parameters rather than separately (Zhang et al., 2020).

Conclusion

The findings of this Case-Control study comparing 200 patients with Type 2 Diabetes Mellitus (T2DM) to 100 healthy controls provide compelling evidence of a direct and significant association between poor glycemic control and the presence of renal dysfunction. The mean values across all metabolic parameters were found to be **highly significantly different** in the diabetic group, confirming their state of uncontrolled hyperglycemia. More critically, the mean eGFR of the T2DM patients 60.62 ± 16.05 mg/dl, coupled with significantly elevated serum creatinine 1.43 ± 0.40 mg/dl and uric acid levels 5.01 ± 0.78 mg/dl indicates that the average patient has already progressed to the stage of **Chronic Kidney Disease (CKD) Stage III** (moderate renal impairment). Furthermore, the significant positive correlation between elevated blood glucose levels (FBS and PPBS) and eGFR underscores the pathological link between hyperglycemia and the initiation of renal damage, likely through mechanisms like hyper filtration. In summary, the study concludes that established Type 2 Diabetes Mellitus carries a high and immediate burden of significant renal compromise, emphasizing the urgent need for stringent glycemic control as the most effective intervention to delay the progression of diabetic nephropathy and preserve long-term kidney health in this patient population.

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