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Correlation of Serum Urea and Serum Creatinine in Diabetics patients and Non-Diabetic Individuals in East India

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ABSTRACT: -

Background: - Chronic hyperglycemia brought on by abnormalities in the metabolism of proteins, fats, and carbohydrates is a hallmark of diabetes mellitus. Absolute or relative deficits in insulin secretion, action, or both are linked to diabetes mellitus. Twenty to thirty percent of people with diabetes will show signs of nephropathy. Macroalbuminuria and aberrant renal function, as indicated by a decrease in glomerular filtration and an increase in serum urea and creatinine levels, are the hallmarks of diabetic nephropathy (DN). **Objective:-** Estimating blood urea and creatinine concentrations in diabetics and normal subjects was the goal of this study. The purpose of this study was to determine how blood glucose levels in both diabetic and non-diabetic participants relate to urea and creatinine levels. **Materials and Methods:** This was cross-sectional comparative study was carried out in the Department of Biochemistry at Gouri Devi Institute of Medical Science & Hospital, Durgapur, WB, India. The study included 100 known Diabetes mellitus patients with age range from 40 to 60 years, and 100 age-matched healthy controls. . For the estimation of plasma glucose, we used Colorimetric/Spectro-photometry using Glucose Oxidase Peroxidase (GOD-POD) method as it is considered as the gold standard. Creatinine was estimated by the modified Jaffe's Method while Urea by Urease-GLDH method on the equipment - Vitrous 350, a Fully Automated Biochemistry Analyser. **Results:** The mean (± S.D) blood glucose fasting and post prandial in non-diabetic controls (n=100) was found to be 91.64 ± 11.26 and 125.35 ± 8.41 respectively, whereas in diabetic subjects it was found to be 177.47 ± 31.52 and 265.15 ± 46.57 respectively. The statistical analysis data showed that the mean fasting and post prandial blood glucose levels are significantly ($p < 0.001$ and 0.003) higher in the diabetic subjects compared to non-diabetic controls. **Conclusion:** The best biochemical markers for evaluating renal function in diabetes individuals

are serum urea and serum creatinine. Long-term diabetes and poor blood glucose control have an impact on renal function and cause early renal damage in diabetic individuals. Therefore we advise patients with diabetes to have their blood glucose levels, serum urea and creatinine levels regularly and vigilantly monitored.
Keywords: blood glucose, creatinine, diabetes mellitus, urea.

INTRODUCTION:

Chronic hyperglycemia brought on by abnormalities in the metabolism of proteins, fats, and carbohydrates is a hallmark of diabetes mellitus. Absolute or relative deficits in insulin secretion, action, or both are linked to diabetes mellitus.[1] Diabetes mellitus has the potential to spread like wildfire in India. [2] In India, diabetes mellitus is potentially becoming an epidemic. [3]

Low- and middle-income nations, such as those in Asia and Africa, are seeing the most rise in prevalence. [4] The World Health Organization (WHO) 2006 diagnostic criteria for diabetes mellitus (DM) include HbA1C ≥ 6.5%, fasting plasma glucose ≥ 126 mg/dl (7.0 mmol/l), or 2-hour plasma glucose ≥ 11.1 mg/l (200 mg/dl). [5] Diabetic nephropathy is a kind of chronic kidney disease, and diabetes is the leading cause of renal morbidity and mortality. [6] Weight loss, blurred eyesight, polyphagia, polydipsia, and polyuria are among the major signs of diabetes. [7] Twenty to thirty percent of people with diabetes will show signs of nephropathy. Macroalbuminuria and aberrant renal function, as indicated by a decrease in glomerular filtration and an increase in serum urea and creatinine levels, are the hallmarks of diabetic nephropathy (DN). [8] End-stage renal disease (ESRD), also known as chronic kidney failure, is primarily caused by diabetes. [9] Urinary microalbuminuria more than 300 mg/dL is a hallmark of diabetic nephropathy. [10] Numerous serum levels of renal markers rose in diabetic nephropathy. [11] Chronic kidney disease (CKD), nephrotic syndrome, and proteinuria are linked to diabetic nephropathy. [12] It is crucial to detect renal failure in diabetes patients as soon as possible. [13] Therefore, early detection of diabetic nephropathy is crucial to preventing the development of end-stage renal failure. [14] Diabetic nephropathy, which affects 25–45% of diabetics, is a condition that patients with diabetes are likely to experience. [15] Conversely, serum urea is a predictor of renal impairment and a prognostic indication. [16] Globally, 170 million individuals have diabetes, and by 2030, that figure might rise to 438 million. [17]

In a tertiary hospital, our study sought to evaluate the relationship between serum creatinine and urea levels in diabetic patients and non-diabetic persons, examining differences in relation to blood glucose levels and type-2 diabetes disease duration. We looked at the usefulness of estimating these levels as a diagnostic and prognostic tool for diabetic nephropathy.

AIMS AND OBJECTIVES:

1. Estimating blood urea and creatinine concentrations in diabetics and normal subjects was the goal of this study.
2. The purpose of this study was to determine how blood glucose levels in both diabetic and non-diabetic participants relate to urea and creatinine levels.
3. To determine the frequency and contributing factors of urea and serum creatinine impairment in patients with type 2 diabetes.

MATERIALS AND METHODS:

This was cross-sectional comparative study was carried out in the Department of Biochemistry at Gouri Devi Institute of Medical Science & Hospital, Durgapur, WB, India, from December 2022 to october 2023. The study included 100 known Diabetes mellitus patients with age range

from 40 to 60 years, and 100 age-matched healthy controls. The sample size was calculated using Open Epi software with a 95% confidence interval. The study received approval from the Institutional Ethics Committee (IEC) of Gouri Devi Institute of Medical Science & Hospital, All the subjects were informed about the scientific nature of the study and written informed consent was obtained from all participants. Patients presenting to the Medicine OPD with past history of Diabetes mellitus for the last 3 years, were taken as cases in this study. For the estimation of plasma glucose, we used Colorimetric/Spectro- photometry using Glucose Oxidase Peroxidase (GOD-POD) method as it is considered as the gold standard. Creatinine was estimated by the modified Jaffe's Method while Urea by Urease-GLDH method on the equipment - Vitrous 350, a Fully Automated Biochemistry Analyser.

Inclusion criteria: Patients with past history of diabetes mellitus for last 3 years were taken as cases, Patients aged 40 years and above.

Exclusion criteria: Our study does not include patients with known renal failure, smokers, hypertensives, hyperlipidemics, pregnant women, or those with other chronic conditions. Individuals with muscular dystrophy, congestive heart failure, urinary tract blockage, other kidney diseases, myopathies, and autoimmune disorders were not included.

COLLECTION OF BLOOD SAMPLE FOR THE STUDY:

Collected venous blood under aseptic conditions. Patient should be fasting (8–12 hours), especially for glucose. Used plain tube for urea and creatinine. Used fluoride oxalate tube for glucose to prevent glycolysis. Performed centrifugation and separate serum/plasma promptly. Store sample at 2–8°C if delayed.

STATISTICAL ANALYSIS :

The data collected was analyzed using SPSS-25. The statistical data was analyzed by student's t-test to compare the significance between diabetic and non-diabetic control groups. The data was expressed as mean and standard deviation (mean±SD). p value of less than 0.05 ($P \leq 0.05$) was considered as statistically significant.

RESULTS:

In this study the case group consisted of 100 patients suffering from Diabetes (37 female, 63 male) and the control group consisted of 100 healthy subjects who were attending the OPD for regular checkup (39 female,61 male). Mean age and standard deviation of case and control groups were 49.83 ± 9.6 years and 51.57 ±8.42 years, respectively. Age group of patients and controls both were 40-60 years.

In our study, of the total n=100 diabetic subjects, n=17 had raised urea level and 16 subjects had raised creatinine level. On the other hand, out of n=100 controls, no subject had high urea level and 2 had increased creatinine level (Table 2). The raised creatinine in normal subjects may likely be due to high muscle mass and high protein meal intake.

The mean (± S.D) blood glucose fasting and post prandial in non-diabetic controls (n=50) was found to be 91.64 ± 11.26 and 125.35 ± 8.41 respectively, whereas in diabetic subjects it was found to be 177.47 ± 31.52 and 265.15 ± 46.57 respectively. The statistical analysis data showed that the mean fasting and post prandial blood sugar levels are significantly ($p < 0.001$ and 0.003) higher in the diabetic subjects compared to non-diabetic controls (Table 3 and Fig. 1).

The mean (± S.D) values of blood urea in non-diabetic control group were found to be 26.24 ± 3.65, whereas in diabetic patients 56.71 ± 12.37. The mean (±S.D) serum creatinine levels in healthy controls was observed to be 0.87 ± 0.16 and in diabetic subjects 1.92 ± 0.82 (Table 3). Thus, the mean blood urea and serum creatinine levels were significantly ($p \leq 0.01$ and 0.02)

higher in the diabetic subjects over non-diabetic control group.

Gender	Group-1 (Diabetic Patients)		Group-2(Control, Non-Diabetic)	
	No.of Participants	Percentage(%)	No.of Participants	Percentage(%)
Male	63	63%	61	61%
Female	37	37%	39	39 %
Total	100		100	

Table 1: Age and sex wise distribution in two groups.

Parameters (mg/dl)	Diabetic (n=100)	Non-Diabetic Control (n=100)
Raised blood urea	27	0
Raised serum creatinine	26	2

Table 2: Comparison of Raised blood urea and serum creatinine levels in diabetic and non-diabetic control subjects.

Parameters (mg/dl)	Non-diabetic controls (n=100)	Diabetic (n=100)	p value
Blood Glucose (fasting)	91.64 ± 11.26	177.47 ± 31.52	0.001*
Blood Glucose (post prandial)	125.35 ± 8.41	265.15 ± 46.57	0.003*
Blood urea	26.24 ± 3.65	56.71 ± 12.37	0.001*
Serum creatinine	0.87 ± 0.16	1.92 ± 0.82	0.002*

* p value less than 0.05 ($p \leq 0.05$) was considered as statistically significant.

Table 3: Mean and SD values of blood urea, serum creatinine and blood glucose levels in diabetic patients and non-diabetic healthy controls.

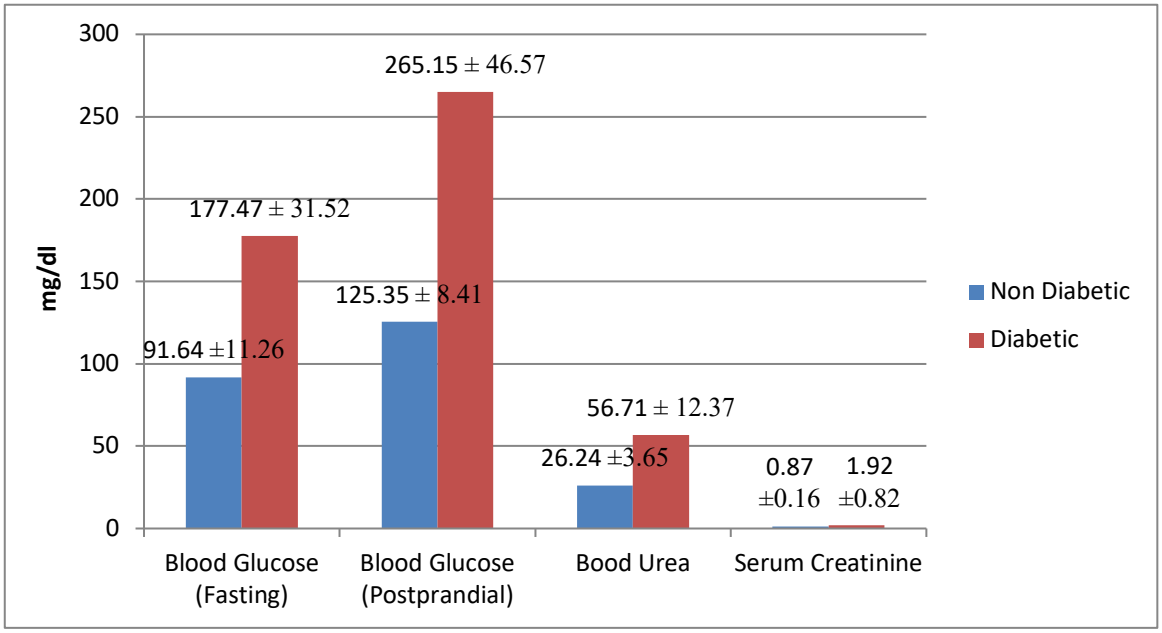

Fig 1: Mean of blood urea, serum creatinine and blood Glucose levels in diabetic patients and non-diabetic healthy controls.

Parameters (mg/dl)	Male (n=63)	Female (n=37)	Total (n=100)
Blood Glucose (Fasting)	177.32 ± 46.71	158.43 ± 26.56	177.47 ± 31.52
Blood Glucose (post prandial)	279.04 ± 51.03	247.07 ± 29.41	265.15 ± 46.46

Table 4: Gender-wise correlation of blood glucose level (BGL) status in Diabetes mellitus

Parameters (mg/dl)	Male (n=63)	Female (n=37)	Total (n=100)
Blood urea	42.21 ± 9.78	35.36 ± 6.23	56.71 ± 12.37
Serum creatinine	2.43 ± 0.78	1.43 ± 0.32	1.925 ± 0.82

Table 5: Gender-wise correlation of renal function test (RFT) in Diabetes mellitus.

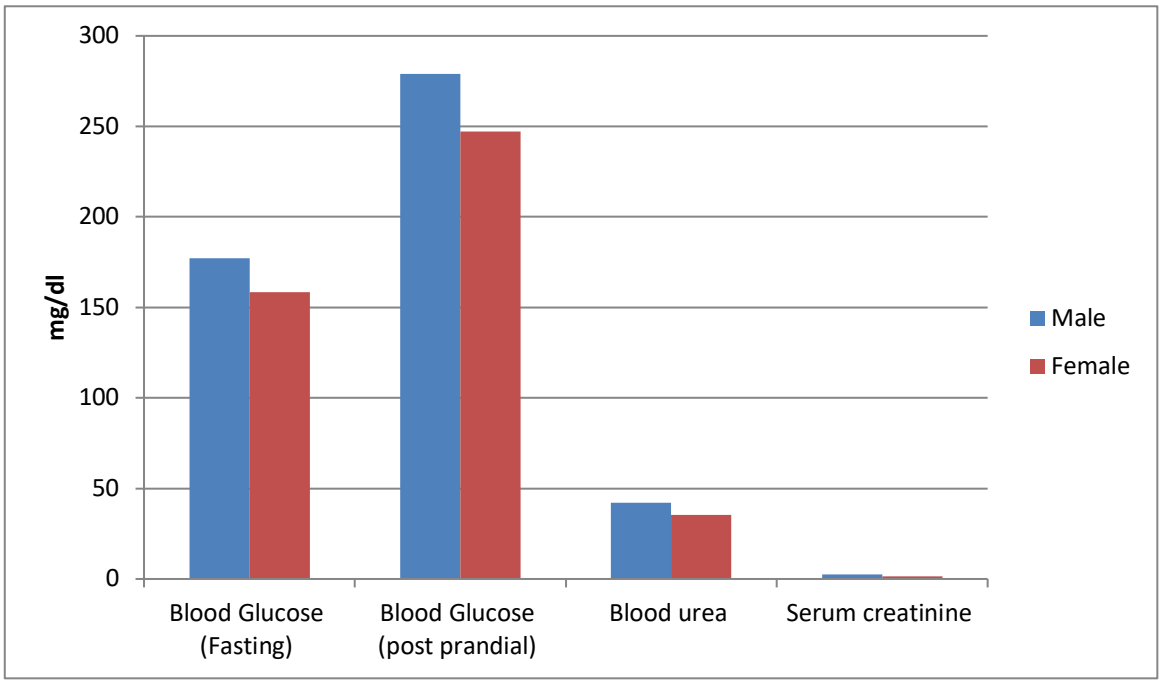

Fig 2: Gender-wise correlation of blood glucose level (BGL) status and renal function test (RFT) in Diabetes mellitus.

DISCUSSION:

Diabetes mellitus is characterized by chronic hyperglycemia due to derangement in carbohydrate, fat, and protein metabolism. Diabetes mellitus is associated with absolute or relative deficiencies in insulin secretion, insulin action or both. DM is the major cause of renal morbidity and mortality, and diabetic nephropathy is one of chronic kdney failure. Approximately twenty to thirty percent of all diabetics will develop evidence of nephropathy. Serum urea and creatinine is a prognostic indicator and predictor of renal impairment.

In our study, of the total n=100 diabetic subjects, n=17 had raised urea level and 16 subjects had raised creatinine level. In diabetic subjects it was found to be 177.47 ± 31.52 and 265.15 ± 46.57 respectively. The statistical analysis data showed that the mean fasting and post prandial blood glucose levels are significantly ($p < 0.001$ and 0.003) higher in the diabetic subjects compared to non-diabetic controls. The mean (± S.D) values of blood urea and creatinine in diabetic patients is 56.71 ± 12.37 and 1.92 ± 0.82 respectively. Thus, the mean blood urea and serum creatinine

levels were significantly ($p \leq 0.01$ and 0.02) higher in the diabetic subjects over non-diabetic control group. There are some studies which is very similar to our study are given here under.

Kapoor S. and Aldler AI in a study showed that the blood urea levels increased proportionally to the increase in serum creatinine. [13,18] Judykay T. et al. in a study concluded that raised serum creatinine and blood urea levels in diabetic patients may indicate a pre-renal problem. [19]

The studies conducted by Anjaneyulu and Chopra had found that increase blood urea and serum creatinine in diabetic indicates progressive renal damage. [20]

Venugopal S. et al. in their study reported that increased blood urea and serum creatinine levels in diabetics clearly indicate prolonged hyperglycaemia which causes irretrievable damage to nephrons of the kidney. [21]

Bamanikar SA, et al. in a study reported that the prevalence of Creatinine and urea impairment was relatively high in type 2 diabetic patients. [1] Sirivole MR et al. in a study concluded that blood urea and serum creatinine levels are simple tests helpful in poorly controlled diabetes to assess the renal function. [22] Romy. W. Marshnil in their study reported that Serum urea and serum creatinine are the best biochemical indicators for assessing renal function in diabetic patients. [23]

CONCLUSION:

The best biochemical markers for evaluating renal function in diabetes individuals are serum urea and serum creatinine. Long-term diabetes and poor blood glucose control have an impact on renal function and cause early renal damage in diabetic individuals. Therefore, in order to stop diabetes mellitus from developing into diabetic nephropathy and renal failure, we advise patients with diabetes to have their blood glucose levels and serum urea and creatinine levels regularly and vigilantly monitored.

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No funding was required or provided for this investigation.

CONFLICT OF INTERESTS:

No conflicts of interest are disclosed by the authors.

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