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Original Research Article

A Comparative Analysis of Serum Creatinine and Urea in Diabetic and Non-Diabetic Individuals

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Abstract:

Introduction: Diabetes mellitus is a serious worldwide health concern because of its effects on many organ systems, notably kidney function. The purpose of this research was to examine the interrelationships and consequences of serum urea, serum creatinine, and blood sugar levels in persons (diabetic and non-diabetic).

Materials and Procedure: Fifty diabetic and twenty non-diabetic individuals were evaluated during a three-month period at the SCB Medical college and Hospital, Cuttack, Odisha, India. Urea, creatinine, and blood sugar levels were measured using blood samples. Statistical calculations were used to examine the relationships and associations between these biomarkers.

Results: In diabetic individuals, there was a strong positive association between blood sugar and serum urea levels, indicating a relationship between glycemic management and renal function. Serum urea and creatinine have emerged as viable indicators for monitoring diabetic kidney impairment. Notably, gender disparities in serum creatinine levels were discovered, necessitating additional research. Conclusion: Effective blood sugar control is critical in avoiding diabetic nephropathy. In diabetes, serum urea and creatinine are useful indices for evaluating kidney function. The study emphasises the importance of monitoring kidney health and functioning tests in the management of type 2 diabetes and urges for more research to improve diabetes treatment practises.

Introduction

Diabetes mellitus is a chronic metabolic condition characterised by increased blood sugar levels caused by insufficient insulin secretion by the pancreas, insufficient insulin utilisation by the body's cells, or both [1]. This disorder causes problems with glucose, lipid, and protein metabolism. Hyperglycaemia, or persistently high blood glucose levels, is linked to a variety of long-term issues affecting several organ systems, including the eyes, kidneys, nerves, and cardiovascular system [1]. Type 1 diabetes mellitus is characterised by a lack of insulin production, while Type 2 is characterised by the body's cells becoming resistant to insulin or failing to use it properly. Diabetes management includes lifestyle changes, medication, insulin treatment, and frequent blood glucose testing to avoid complications and maintain optimum health [2]. Diabetes mellitus severe consequences include cardiovascular difficulties such as heart disease and stroke, nerve damage resulting in "neuropathy," and kidney impairment (nephropathy). Extreme instances may also include "diabetic ketoacidosis" (DKA) or "hyperosmolar hyperglycaemic state" (HHS), both potentially fatal illnesses caused by excessively high blood sugar levels [2].

Diabetes nephropathy, a consequence of long-term diabetes, predominantly affects the glomeruli, the crucial structures responsible for filtration in the kidney. Over time, "Diabetes Mellitus" wreaks havoc on the kidney's delicate filtration mechanism. This mechanism first gets weakened, allowing bigger blood proteins such as albumin to escape into the urine, a condition known as "proteinuria" [3]. This leakage acts as an early warning sign of kidney impairment in diabetics. Notably, the danger of such harm increases when blood sugar levels are inadequately regulated. As diabetes advances, this initial leakage worsens, leading to the emergence of more serious disorders such as nephrotic syndrome, which is characterised by considerable protein loss in urine, edoema, and elevated cholesterol. Chronic renal failure may

develop as a result of extensive kidney injury and reduced kidney function [3, 4].

Regular blood sugar, blood pressure, and kidney function monitoring is critical in diabetes management to prevent or postpone the start and progression of diabetic nephropathy. Early intervention, including lifestyle changes and medication, is critical in reducing the risk of renal problems in people with diabetes [4].

Elevated urea and creatinine levels in the blood suggest poor filtration or diminished renal function. When the kidneys are working correctly, they filter these waste products out of the circulation and maintain their levels within a normal range. However, if the kidneys are not functioning properly, urea and creatinine build in the blood, suggesting decreased kidney function; hence, assessing creatinine and urea levels is considered a test for evaluating renal function [4]. This test aids in the diagnosis and monitoring of a variety of kidney problems, such as chronic kidney disease, acute kidney injury, and other illnesses that influence renal function. It reveals important information about the kidneys' capacity to properly filter waste materials from the blood [5]. Furthermore, the urea to creatinine ratio may sometimes provide additional information on the source of renal impairment, assisting healthcare providers in identifying effective therapy and management methods for kidney-related disorders [5]. The study will look at serum urea and creatinine levels in diabetic and non-diabetic people to see whether there is a link between glucose levels and urea and creatinine levels in blood.

Materials and Methods

The research was carried out at the SCB Medical college and Hospital, Cuttack, Odisha, India. For the study, 50 diabetes samples were evaluated, with 20 non-diabetic samples serving as controls. The samples were evaluated for three months at the Medical College's Pathology Department. Diabetes was diagnosed according to WHO guidelines, and the individuals involved in the research ranged in age from 30 to 60. Participants with urinary tract obstruction, congestive heart failure, other long-term renal problems, or "muscular dystrophy" were excluded from the trial. Before the trial began, the patients completed an informed written permission and agreement form.

Each participant had 10 mL of blood drawn for measurement of urea, blood sugar, and creatinine serum levels. The blood glucose level was determined using the "Glucose Oxidase-Peroxidase method," urea was determined using the "Urease Berthelot's method," and serum creatinine was determined using the "Jaffe's Method" [6, 7]. The glucose, serum creatinine, and urea standard deviations were calculated.

Result

The total number of participants in the research study was 70 (50 diabetic and 20 non-diabetic), 35 males and 35 females, as shown in Table 1. In the control group, all 20 non-diabetic subjects had normal urea levels, although one had slightly higher blood creatinine levels. Control people with elevated creatinine levels may have increased muscle mass or consumed more protein than usual. In a study of 50 diabetes individuals, urea levels were found to be abnormal in 10 of them. Four of them showed high serum creatinine levels.

Table 1: Analysis of creatinine and urea levels in diabetics and non-diabetic categories

Categories	Diabetic Patients (N=50)	Non-Diabetic Patients (N=20)
Urea	10	0
Serum Creatinine	4	1

Table 2: Blood analysis in diabetic patients compared to healthy controls

Categories	Diabetic Patients	Non-Diabetic Patients
Urea Levels	19.23±5.75	26.99±21.23
Serum Creatinine	0.99±0.02	1.17±0.87
Blood Sugar (fasting)	86.02±7.98	135.33±69.87
Blood Sugar (post lunch)	130.67±8.09	169.22±75.44

Several discrepancies emerged from a detailed analysis of diabetes and non-diabetic groups in table 2 above. Diabetic patients had considerably lower urea levels (19.23 5.75 mg/dL) than non-diabetic people (26.99 21.23 mg/dL). Diabetic individuals, on the other hand, had somewhat lower blood creatinine levels (0.99 0.02 mg/dL) than non-diabetic counterparts (1.17 0.87 mg/dL). In terms of blood sugar levels, the diabetic group had significantly lower fasting and post-lunch measures. Diabetic patients had an average fasting blood sugar of 86.02 7.98 mg/dL, whereas non-diabetic individuals had 135.33 69.87 mg/dL. Similarly, diabetics had significantly lower post-lunch blood sugar levels (130.67 8.09 mg/dL) than non-diabetics (169.22 75.44 mg/dL). In both situations (after meal and fasting), there was a notable significant positive connection between urea levels and blood glucose levels. This relationship implies that when blood sugar levels

rise, so do serum urea levels. Creatinine and glucose levels, on the other hand, showed a weaker association, suggesting a less evident link between these variables. When the influence of gender on these parameters was investigated, non-significant associations and negative correlations between blood sugar levels, serum urea, and gender were discovered. While serum urea and blood sugar levels show substantial positive connections, other indicators such as serum creatinine levels show lesser links, with gender having a minimal influence in these interactions.

Discussion

The researchers at Bhima Bhoi Medical College and Hospital wanted to compare urea, glucose, and creatinine levels in diabetic and non-diabetic people. The results shed light on different patterns and connections between these metrics, providing insights into diabetic kidney function and blood glucose management. The most intriguing finding was a significant positive relationship between urea levels and glucose levels in post-meal and fasting testing. Our findings show that poor blood sugar control leads to higher serum urea levels, possibly increasing the risk of diabetic nephropathy in patients. This is consistent with earlier research demonstrating that elevated blood sugar levels play a substantial role in the evolution of kidney impairment in diabetes [6, 7]. This strong link shows a direct link between high urea levels and rising glucose levels. The results suggest that changes in blood glucose levels may have a direct influence on urea levels, perhaps indicating renal function in diabetics [6].

Serum creatinine levels, on the other hand, showed less positive relationships with blood sugar levels, especially in the whole study sample. A fascinating gender-based finding demonstrated a stronger positive association between glucose and blood creatinine levels in guys. This might be due to male candidates' increased protein consumption. Elevated urea levels are often associated with renal injury. High blood sugar levels in diabetic individuals, together with elevated blood urea levels, indicate probable renal damage [8]. Previous research on diabetic rats has shown that increased urea and serum creatinine levels correlate with the advancement of renal impairment [7, 8]. In our study, we found a high link between the duration of diabetes, its severity, and blood urea levels, but not with creatinine levels. This is consistent with the notion that creatinine and urea levels act as indicators of "Glomerular Filtration Rate" (GFR). Most of the requirements for an ideal filtration marker are met by serum creatinine, which is a more ideal and sensitive measure of renal health and function than urea [8, 9].

There was no association observed between gender and blood sugar levels, nor was there a significant relationship between gender and urea levels. Prior scientific study revealed equivalent results [9, 10]. Our findings are consistent with earlier studies suggesting that increased urea and serum creatinine levels in diabetic patients may indicate an early kidney problem [10, 11].

In diabetic patients, serum creatinine and urea levels are the most important "prognostic markers" and predictors of renal diseases and damage [12]. Controlling blood sugar levels may prevent the progression of "diabetic nephropathy," greatly decreasing morbidity and death. Renal function testing and analysis is a simple, predictable, and cost-effective strategy that is currently recognised as an additional tool in the treatment and long-term management of Diabetes mellitus type 2 [13].

Conclusion

Finally, our findings show a strong association between blood glucose levels and urea levels in diabetic individuals, indicating a possible relationship between glycemic management and renal function. Urea and serum creatinine are useful indicators for tracking renal impairment in diabetics. Effective blood sugar control is critical in the prevention of diabetic nephropathy. Gender variations in serum creatinine levels should be investigated further. Assessing renal function tests, particularly serum creatinine and urea, aids in the treatment of Type 2 Diabetes Mellitus. Additional investigation into these associations may improve diabetes treatment techniques.

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