



Correlation Between Glycated Hemoglobin (HbA1C) and Renal Function in Newly Diagnosed Diabetes Mellitus Type 2: A Comparative Study

Kush Manna¹, Dr. Jaya Jain²

¹Ph.D. Scholar, Department of Biochemistry, Index Medical College Hospital and Research Center, Indore (M.P.)

²Professor, Department of Biochemistry, Index Medical College Hospital and Research Center, Indore (M.P.)

DOI : <https://doi.org/10.55248/gengpi.6.0625.22114>

ABSTRACT:

Background: Diabetes mellitus type 2 (T2DM) is a chronic metabolic disease characterized by hyperglycemia and insulin resistance. Diabetic nephropathy, or DKD, is a long-term consequence of T2DM, causing kidney damage and progressive deterioration in renal function. Early stages may have normal creatinine and eGFR readings, but microalbuminuria can indicate kidney impairment. As the condition worsens, glomerular filtration rate decreases.

Aims & Objectives: The study aims to correlate glycated hemoglobin and renal function parameters in newly diagnosed Diabetes Mellitus type 2 and control groups, estimating HbA1c, urea, creatinine, and uric acid.

Materials & Methods: A study was conducted at Index Medical College Hospital and Research Center in Indore, India, involving 200 samples from individuals aged 30-70 with newly diagnosed type 2 diabetes, without prior treatment. The study used Trinder's method for fasting blood sugar, Nathan D M et al.'s method for HbA1c, Berthelot method for serum urea, Jaffe method for serum creatinine, and Uricase method for serum uric acid.

Observations & Results: The study found significant positive correlations between HbA1c, FBS, Serum Urea, Serum Creatinine, and Serum Uric Acid in two groups. HbA1c was 6.68% in Group 1 and 5.215% in Group 2. FBS was 130.36 mg/dl in Group 1 and 102.45 mg/dl in Group 2. Serum Urea was 36.26 mg/dl in Group 1 and 25.54 mg/dl in Group 2. Serum Creatinine was 1.09mg/dl in Group 1 and 0.92 mg/dl in Group 2. Serum Uric Acid was 4.68 mg/dl in Group 1 and 3.7 mg/dl in Group 2.

Conclusion & Summary: A study conducted at Index Medical College Hospital in Indore, India, found that high levels of HbA1c, FBS, serum urea, creatinine, and uric acid are early signs of renal failure in Type 2 Diabetes Mellitus patients. The study highlights the importance of early identification and monitoring for renal function management, suggesting potential treatment for T2DM without prior treatment.

Keywords: Serum Creatinine, Serum Urea, Serum Uric Acid, T2DM.

Introduction:

Diabetes mellitus type 2 (T2DM) is a chronic metabolic disease characterized by hyperglycemia and insulin resistance. Diabetic nephropathy, also known as Diabetic Kidney Disease (DKD), is a significant long-term consequence of T2DM. Chronic hyperglycemia leads to kidney damage, including glomerular basement membrane thickening, mesangial enlargement, and glomerulosclerosis. This damage can cause albuminuria, a sign of early kidney involvement, and progressive deterioration in renal function. Early stages of diabetic nephropathy may have normal serum creatinine and eGFR readings, but microalbuminuria can indicate kidney impairment.⁽¹⁻⁴⁾ As the condition worsens, the estimated glomerular filtration rate decreases and serum creatinine and blood urea nitrogen levels increase, indicating deteriorating renal function. High HbA1c levels have been linked to compromised renal parameters, suggesting poor glycaemic control accelerates kidney disease development.

Aims & Objectives:

Aim: To correlate between Glycated Hemoglobin and Renal Function Parameter in newly diagnosed Diabetes Mellitus type 2 group and Control group.

Objectives:

- To estimate the HbA1c, Serum Urea, Serum Creatinine and Serum Uric Acid in Newly Diagnosed Diabetes Mellitus type 2 group and Control Group.
- To correlate HbA1c and Renal markers for both the groups.

Materials & Methods: A prospective study was conducted in the Department of Biochemistry, Index Medical College Hospital and Research Center, Indore (M.P.) and total of 200 samples of each group was selected. Group 1 was Newly Diagnosed Diabetes Mellitus type 2 and Group 2 was Control Group. The study included identify individuals aged 30-70 with newly diagnosed T2DM, without prior diabetes treatment, and excludes those with a history of chronic kidney disease or nephrotoxic drug use.

Methods:

S.No.	Parameter	Method
1.	Fasting Blood Sugar	Trinder's (1969) Method ⁽⁵⁾
2.	HbA1c	Nathan D M et al.(2008) method ⁽⁶⁾
3.	Serum Urea	Berthelot Method ^(7,8)
4.	Serum Creatinine	Jaffe Method ⁽⁹⁾
5.	Serum Uric Acid	Uricase Method ⁽¹⁰⁾

Observations & Results:

Table 1: Comparison between HbA1c and Kidney Function Parameters in Newly Diagnosed Diabetes Mellitus type 2 and Control Group

	HbA1c (%)	FBS (mg/dl)	Serum Urea (mg/dl)	Serum Creatinine (mg/dl)	Serum Uric Acid (mg/dl)
Group 1 (T2DM)	6.86±0.21	130.36±2.69	36.26±8.39	1.09±0.28	4.68±0.53
Group 2 (Control)	5.215±0.33	102.45±9.39	25.54±4.58	0.92±0.18	3.7±0.39
r-value		0.91	0.95	0.99	0.99
p-value		Significant	Significant	Significant	Significant

In table no. 1, the Mean and SD value for HbA1c was 6.68% (SD 0.21%) for Group 1 and for Group 2 the value was 5.215% (SD 0.33%) for Control Group. The Mean and SD of FBS for Group 1 and Group 2 was 130.36 mg/dl (SD 2.69 mg/dl) and 102.45 mg/dl (SD 9.39 mg/dl) respectively. And the value for Serum Urea was 36.26 mg/dl (SD 8.39 mg/dl) for Group 1 and 25.54 mg/dl (SD 4.58 mg/dl) and for Group 2, the value was 25.54 mg/dl (SD 4.48 mg/dl). The Mean and SD for Serum Creatinine for Group 1 and Group 2 was 1.09mg/dl (SD 0.28 mg/dl) and 0.92 mg/dl (SD 0.18 mg/dl) respectively. Finally, the Mean and SD for Serum Uric Acid was 4.68 mg/dl (SD 0.53 mg/dl) for Group 1 and for Group 2, the value was 3.7 mg/dl (SD 0.39 mg/dl). And the parameters shows significant positive correlation.

Discussion:

The study found significant positive correlations between HbA1c, FBS, Serum Urea, Serum Creatinine, and Serum Uric Acid in two groups. HbA1c was 6.68% in Group 1 and 5.215% in Group 2. FBS was 130.36 mg/dl in Group 1 and 102.45 mg/dl in Group 2. Serum Urea was 36.26 mg/dl in Group 1 and 25.54 mg/dl in Group 2. Serum Creatinine was 1.09mg/dl in Group 1 and 0.92 mg/dl in Group 2. Serum Uric Acid was 4.68 mg/dl in Group 1 and 3.7 mg/dl in Group 2. So, poor glycaemic management in newly diagnosed Type 2 Diabetes Mellitus patients is linked to early renal function changes. Our study resemble with the study conducted by Divya Pandya et al. (2016)⁽¹¹⁾, Sandeep Kumar et al. (2022)⁽¹²⁾, Akshay Shirsath et al. (2019)⁽¹³⁾. Elevated HbA1c and FBS levels suggest early renal involvement, suggesting the need for early screening and routine renal parameter monitoring to prevent progression.

Conclusion:

Our study reveals that high levels of HbA1c, FBS, serum urea, creatinine, and uric acid are early signs of renal failure in Type 2 Diabetes Mellitus patients, emphasizing the importance of early identification and monitoring for renal function management.

Summary:

A study was conducted at Index Medical College Hospital and Research Center in Indore, India, involving 200 samples from individuals aged 30-70 with newly diagnosed Type 2 Diabetes. The study found significant positive correlations between HbA1c, FBS, urea, creatinine, and uric acid levels in both groups. The results showed a significant positive correlation between the parameters, indicating a potential treatment for T2DM without prior treatment.

Reference:

1. Galicia-Garcia U, Benito-Vicente A, Jebari S, Larrea-Sebal A, Siddiqi H, Uribe KB, Ostolaza H, Martín C. Pathophysiology of Type 2 Diabetes Mellitus. *Int J Mol Sci.* 2020 Aug 30;21(17):6275.
2. Goyal R, Singhal M, Jialal I. Type 2 Diabetes. 2023 Jun 23. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. PMID: 30020625.
3. Sinha S, Haque M. Insulin Resistance and Type 2 Diabetes Mellitus: An Ultimatum to Renal Physiology. *Cureus.* 2022 Sep 8;14(9):e28944.
4. Amorim RG, Guedes GDS, Vasconcelos SML, Santos JCF. Kidney Disease in Diabetes Mellitus: Cross-Linking between Hyperglycemia, Redox Imbalance and Inflammation. *Arq Bras Cardiol.* 2019 Jun 6;112(5):577-587.
5. Trinder P. Determination of glucose in blood using glucose oxidase with an alternative oxygen acceptor. *Ann Clin Biochem.* 1969; 6:24-30.
6. Nathan D M, Kuenen J, Borg R, Zheng H, Schoenfeld D, Heine R J. Translating the A1c assay into estimated average glucose values. *Diabetes care.* 2008;31:1473-1478.
7. Henry, R.J. *Clinical Chemistry, Principles and Techniques*, Harper and Row, New York, 1968, Page 268.
8. Chaney, A.L. Marbach, C.P. *Clinical Chemistry*, 8:130(1962) Searcy, R.L. Reardon, J.E. Forman, J.A. Amer, J. *Med. Technol* 33.15 (1967)
9. Jaffe, M., *Z. Physiol. Chem.* 10 : 391 (1886).
10. Zhao, Y., Yang, X., Lu, W. *et al.* Uricase based methods for determination of uric acid in serum. *Microchim Acta* 164, 1–6 (2009).
11. Pandya D, Nagrajappa AK, Ravi KS. Assessment and Correlation of Urea and Creatinine Levels in Saliva and Serum of Patients with Chronic Kidney Disease, Diabetes and Hypertension- A Research Study. *J Clin Diagn Res.* 2016 Oct;10(10):ZC58-ZC62.
12. Kumar S, Mondal H, Lata M, Behera JK, Priyadarshini B. Correlation of serum uric acid with lipid profile in patients with type 2 diabetes mellitus with normal creatinine level: Report from a tertiary care hospital in India. *J Family Med Prim Care.* 2022 Jun;11(6):3066-3070.
13. Akshay Shirsath, Virendra C Patil, Makarand Mane, Shilpa Patil. A study of serum uric acid levels in type 2 diabetes mellitus subjects: a cross sectional study. *International Journal of Contemporary Medical Research* 2019;6(1):A21-A24