

ASSESSMENT OF HBA1C LEVELS AMONG PATIENTS WITH TYPE 2 DIABETES MELLITUS ATTENDING A TERTIARY CARE CENTER

Richa Kumari¹, Ramesh Kumar Mandhan², Neha khushboo³

¹Resident, Department of Pathology, MGM Medical College, Jamshedpur, India.

²Professor & HOD, Department of Pathology, MGM Medical College, Jamshedpur, India.

³Resident, MGM Medical College, Jamshedpur, India.

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Corresponding Author:

Dr. Richa Kumari,
Email: richamrit116@gmail.com

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ABSTRACT

Background: Type 2 Diabetes Mellitus is a major public health concern in India, with poor glycemic control leading to serious complications. Glycosylated Hemoglobin(HbA1c) reflects long-term glycemic status and is essential for monitoring diabetes. To evaluate HbA1c levels and their association with socio-demographic factors among patients with Type 2 Diabetes Mellitus attending a tertiary care center. **Material and Methods:** A hospital-based cross-sectional study was conducted among 180 patients with Type 2 Diabetes Mellitus. Socio-demographic data were collected using a predesigned proforma. HbA1c levels were categorized as <6.5%, 6.5–7%, 7.1–8%, and >8%. Data were analyzed using the chi-square test, with $p < 0.05$ considered statistically significant. **Results:** The majority of participants were aged 51–60 years (35.0%), and males constituted 61.1% of the study population. Overall, 33.3% had normal HbA1c levels, 11.1% were near normoglycemic, and 16.7% had good control, while 38.9% had poor glycemic control (HbA1c >8%). No significant association was found between gender and HbA1c levels ($\chi^2 = 3.22$, $df = 3$, $p = 0.36$). However, age showed a significant association ($\chi^2 = 132.4$, $df = 12$, $p < 0.001$), with poor control increasing with advancing age. **Conclusion:** A large proportion of patients had poor glycemic control, particularly in older age groups. Targeted interventions are needed to improve diabetes management.

INTRODUCTION

Type 2 Diabetes Mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia due to insulin resistance and/or impaired insulin secretion. It represents a major global public health challenge, with a rapidly increasing burden in low- and middle-income countries, particularly India. Recent national estimates indicate a rising prevalence of diabetes and prediabetes across different regions of India, with significant age and gender variations.^[1] Glycemic control is central to the management of diabetes, as poor control is associated with long-term complications such as retinopathy, nephropathy, neuropathy, and cardiovascular diseases. Glycated hemoglobin (HbA1c) is widely used as a reliable indicator of long-term glycemic status, reflecting average blood glucose levels over the preceding.^[2-3] months. Current recommendations by the American Diabetes Association and Indian guidelines suggest maintaining HbA1c levels below 7% for optimal control.^[2]

Despite advancements in therapeutic strategies, achieving adequate glycemic control remains a

challenge in India. Recent evidence suggests that more than 50% of individuals with diabetes in India have poor glycemic control (HbA1c >8%), highlighting gaps in disease management.^[3] A 2024 Indian study further demonstrated significant regional variation in HbA1c-based prevalence of diabetes and prediabetes, with higher burden observed in economically productive age groups.^[1] Studies conducted in India during 2024–2025 have consistently reported a high prevalence of uncontrolled diabetes, with estimates ranging from 50% to over 70% of patients failing to achieve target HbA1c levels.^[4-5] Factors contributing to poor glycemic control include longer duration of disease, inadequate lifestyle modification, poor adherence to treatment, and limited health literacy.^[4,6] Additionally, socio-economic disparities and healthcare accessibility issues further aggravate the burden in resource-limited settings.

In states like Jharkhand, the situation is particularly concerning due to disparities in healthcare infrastructure, lower awareness levels, and a significant rural and tribal population. Regional studies have indicated suboptimal glycemic control and a high burden of undiagnosed or poorly managed

diabetes, emphasizing the need for localized data and targeted interventions.

A study in a rural tribal population of Jharkhand found that only one-third of patients achieved good glycemic control, with many having HbA1c levels above 7%. This indicates that poor glycemic control is a common issue in both rural and tertiary care settings, likely attributed to limited awareness, irregular follow-up, and socioeconomic barriers.^[7] Furthermore, recent evidence highlights certain limitations of HbA1c interpretation in the Indian population. Conditions such as anemia and hemoglobinopathies, which are prevalent in India, may affect HbA1c accuracy and lead to misclassification of glycemic status.^[8] Therefore, while HbA1c remains a cornerstone in diabetes monitoring, its interpretation should be contextualized within regional clinical settings.

Given this background, assessing HbA1c levels among patients attending tertiary care centers provides important insights into the status of glycemic control and helps identify gaps in diabetes management. Hence, the present study was undertaken to evaluate HbA1c levels and their association with socio-demographic factors among patients with Type 2 Diabetes Mellitus attending a tertiary care center.

Objective

1. To assess the levels of HbA1c among patients with Type 2 Diabetes Mellitus attending a tertiary care center.
2. To study the association of HbA1c levels with socio-demographic factors (age and sex).
3. To determine the proportion of patients with poor glycemic control (HbA1c >8%).

MATERIALS AND METHODS

A cross-sectional study was conducted at a tertiary care hospital from March 2025 to August 2025, involving 180 participants. The study population included all adult patients aged 30 years and older who were attending outpatient and inpatient departments and provided informed consent. Exclusion criteria encompassed patients with Type 1 diabetes mellitus, gestational diabetes, serious comorbid conditions affecting HbA1c levels (such as hemoglobinopathies and severe anemia), and those unwilling to participate.

Data collection utilized a predesigned proforma to record socio-demographic information, such as age and sex, alongside clinical details from patient records. HbA1c levels were obtained from laboratory reports and classified into four categories: <6.5% (Normal), 6.5–7% (Near normoglycemic), 7.1–8% (Good control with medication), and >8% (Poor glycemic control).

Data were analyzed using Epi-Info statistical software. Descriptive statistics such as frequency and percentage were used to summarize the data. The association between HbA1c levels and sociodemographic variables (age and sex) was assessed using the chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 180 patients were included in the study. Age-wise distribution showed that the majority of participants belonged to the 51–60 years age group (35.0%), followed by 61–70 years (26.1%) and 41–50 years (19.4%). A smaller proportion of patients were in the 30–40 years (11.1%) and >70 years (8.3%) age groups. [Table 1]

Gender distribution revealed that males constituted a higher proportion of the study population (61.1%) compared to females (38.9%). [Table 2]

Distribution of HbA1c levels indicated that 33.3% of patients had normal HbA1c levels (<6.5%), while 11.1% were near normoglycemic (6.5–7%). About 16.7% of patients had good glycemic control with medication (7.1–8%). Notably, the largest proportion of patients (38.9%) had poor glycemic control (HbA1c >8%). [Table 3]

The association between HbA1c levels and socio-demographic variables was assessed among patients with Type 2 Diabetes Mellitus. No statistically significant association was observed between gender and HbA1c levels ($\chi^2 = 3.22$, $df = 3$, $p = 0.36$), although a higher proportion of males exhibited poor glycemic control compared to females. [Table 4]

In contrast, a highly significant association was found between age group and HbA1c levels ($\chi^2 = 132.4$, $df = 12$, $p < 0.001$). The proportion of patients with poor glycemic control (HbA1c >8%) increased markedly with advancing age, with the highest prevalence observed among patients aged >70 years. These findings indicate that age is an important determinant of glycemic control in the study population. [Table 5]

Table 1: Age Group wise Distribution of Study Participants

Age Group	Number of Patients	Percentage (%)
30–40	20	11.1%
41–50	35	19.4%
51–60	63	35.0%
61–70	47	26.1%
>70	15	8.3%

Table 2: Gender wise Distribution of Study Participants

Gender	Number of Patients	Percentage (%)
Male	110	61.1%
Female	70	38.9%

Table 3: Distribution of HbA1c Level in Type 2 Diabetes Mellitus study participants

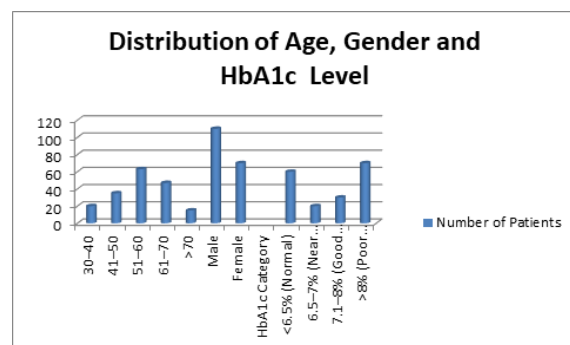
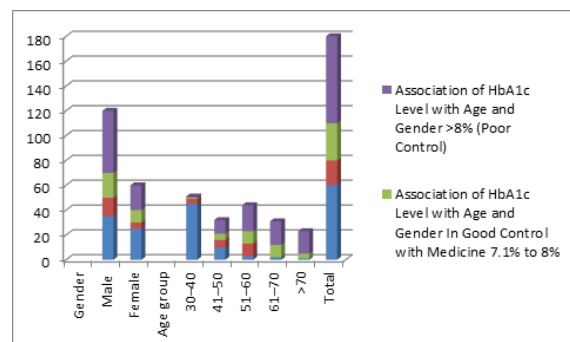
HbA1c Category	Number of Patients	Percentage (%)
<6.5% (Normal)	60	33.3%
6.5–7% (Near Normoglycemic)	20	11.1%
7.1–8% (Good Control with Medicine)	30	16.7%
>8% (Poor Control)	70	38.9%

Table 4: Association of HbA1c Level with Gender

Gender	Normal Level <6.5%	Near Normoglycemic 6.5% to 7%	In Good Control with Medicine 7.1% to 8%	>8% (Poor Control)	χ^2	df	p
Male	35 (29.2%)	15 (12.5%)	20 (16.7%)	50 (41.7%)	3.22	3	0.36
Female	25 (41.7%)	5 (8.3%)	10 (16.7%)	20 (33.3%)			

Table 5: Association of HbA1c Level with Age Group

Age Group	Normal Level <6.5%	Near Normoglycemic 6.5% to 7%	In Good Control with Medicine 7.1% to 8%	>8% (Poor Control)	χ^2	df	p
30–40	45 (88.2%)	4 (7.8%)	1 (2.0%)	1 (2.0%)	132.4	12	< 0.001
41–50	10 (31.3%)	6 (18.8%)	5 (15.6%)	11 (34.4%)			
51–60	3 (6.8%)	10 (22.7%)	10 (22.7%)	21 (47.7%)			
61–70	2 (6.5%)	0 (0%)	10 (32.3%)	19 (61.3%)			
>70	1 (4.3%)	0 (0%)	4 (17.4%)	18 (78.3%)			

**Figure 1: Graphical representation of Age, Gender and HbA1c level of Study Participants****Figure 2: Graphical representation of Association of HbA1c level with gender and Age group**

DISCUSSION

The present study assessed glycemic control using HbA1c levels among patients with Type 2 Diabetes Mellitus attending a tertiary care center. The findings revealed that a substantial proportion of patients had poor glycemic control, with 38.9% having HbA1c levels >8%, indicating inadequate diabetes management.

In this study, the majority of participants belonged to the 51–60 years age group, which is consistent with

the known epidemiological pattern of Type 2 Diabetes Mellitus, where prevalence increases with advancing age. Similar age distributions have been reported in studies from India and other developing countries, reflecting the higher burden of diabetes in middle-aged and elderly populations.^[9]

The gender distribution showed a male predominance (61.1%), which is comparable to findings from hospital-based studies where males tend to access healthcare services more frequently than females. However, the association between gender and HbA1c levels was not statistically significant ($p = 0.36$), suggesting that glycemic control is not markedly influenced by gender alone. This finding is in agreement with previous studies that reported no significant gender-based differences in glycemic control.^[10]

A key finding of the present study was that only one-third (33.3%) of patients had normal HbA1c levels, while the majority had suboptimal control. This aligns with reports from the International Diabetes Federation, which indicate that a large proportion of diabetic patients in low- and middle-income countries fail to achieve recommended glycemic targets.^[11] Poor glycemic control may be attributed to factors such as inadequate treatment adherence, lack of awareness, and limited access to healthcare resources.

Importantly, a highly significant association was observed between age and HbA1c levels ($p < 0.001$), with worsening glycemic control seen in older age groups.^[12] Patients aged >70 years had the highest proportion of poor control (78.3%). This finding is consistent with earlier studies showing that increasing age is associated with longer disease duration, progressive β -cell dysfunction, and the presence of comorbidities, all of which contribute to poor glycemic outcomes.^[13]

The increase in HbA1c with age highlights challenges in managing diabetes in elderly patients, such as polypharmacy, decreased physical activity, and dietary restrictions, which underscores the necessity for personalized treatment approaches.

CONCLUSION

The present study reveals that a considerable number of patients with Type 2 Diabetes Mellitus at a tertiary care center have poor glycemic control, as indicated by nearly 40% having HbA1c levels >8%. Age emerged as a significant factor influencing glycemic control, with poorer outcomes noted in older individuals, while no significant relationship was found between gender and glycemic control. These findings underscore the inadequacy of optimal glycemic management in this population, particularly among elderly patients, despite the accessibility to healthcare services at tertiary centers.

Recommendations

Key recommendations for diabetes management include enhancing patient education on management and medication adherence, conducting regular HbA1c testing, and implementing targeted strategies for elderly patients. Additionally, promoting lifestyle changes such as increased physical activity and better dietary practices is vital. Improving healthcare access in rural areas of Jharkhand and utilizing a comprehensive diagnostic approach that integrates HbA1c with other tests are crucial for better health outcomes.

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