ORIGINAL ARTICLE

Comparative Burden of HbA1c and RBG Levels Among Individuals Above 25 Years in the Post-COVID-19 and Pre-COVID-19 Periods: A Retrospective Analysis at a Medical College Hospital, Ramanagara, Karnataka

Shilpashree Madhava Kunjathur, Akshitha Shivanna, Leelambika

[1]Department of Biochemistry, Dr. Chandramma Dayananda Sagar Institute of Medical Education and Research (CDSIMER) Deverakaggalahalli, KanakapuraRoad, Ramanagara District, Karnataka

CORRESPONDING AUTHOR

Dr Shilpashree MK, Associate Professor, Department of Biochemistry, Dr. Chandramma Dayananda Sagar Institute of Medical Education and Research (CDSIMER), Deverakaggalahalli, KanakapuraRoad, Ramanagara District, Karnataka - 562112

Email: shilpa.sharath@gmail.com

CITATION

Shilpashree MK, Akshitha S, Leelambika. Comparative Burden of HbA1c and RBG Levels Among Individuals Above 25 Years in the Post-COVID-19 and Pre-COVID-19 Periods: A Retrospective Analysis at a Medical College Hospital, Ramanagara, Karnataka. Indian J Comm Health. 2025;37(4):573-578.

https://doi.org/10.47203/IJCH.2025.v37i04.012

ARTICLE CYCLE

Received: 02/05/2025; Accepted: 09/08/2025; Published: 31/08/2025

ABSTRACT

Introduction: The COVID-19 pandemic significantly impacted public health, including metabolic health and glycemic control. SARS-CoV-2 affects glucose metabolism through inflammation, stress, and healthcare disruptions. HbA1c, a key diabetes marker, has shown increased levels post-COVID, suggesting higher hyperglycemia burden. In India, pre-COVID data revealed 12% of women and 14% of men over 15 years had RBG >140 mg/dl, with higher rates reported during COVID due to stress, inflammation, and treatment changes like corticosteroid use. We hypothesized a 15% rise in elevated HbA1c and RBG levels post-COVID among patients over 25 years. This study compared pre- and post-COVID trends by age and gender. **Methods**: The study was conducted at CDSIMER Hospital, as a retrospective observational analysis of HbA1c and RBG levels in patients aged >25 years. Two periods were compared: Pre-COVID-19 (2019–2021) and Post-COVID-19 (2022–2023). Data from the Laboratory Information System (LIS) and NFHS-5 reports were analyzed. Inclusion criteria included complete HbA1c and RBG records. The estimated sample size, based on previous studies, was 10,475. **Results**: A total of 17,238 patients data were analysed. In the post-COVID period, 16.95% had very high levels (?160 mg%), more than doubling from NFHS-5 data. Males showed a higher prevalence (22.15%) than females (12.86%). HbA1c >6.5% was found in 64% of individuals aged >25 years. **Conclusion**: Alarming increase in blood glucose levels among population aged above 25 years. National Health Programmes to take justifiable action on priority.

KEYWORDS

Hyperglycemia; HBAIc; RBG; COVID

INTRODUCTION

The COVID-19 pandemic had huge impact on public health, affecting not only infectious disease patterns but also chronic metabolic conditions such as diabetes. The virus responsible for COVID-19 was SARS-CoV-2 and it has been shown to influence glucose metabolism through multiple mechanisms, including systemic inflammation, stress-induced hyperglycemia, and disruptions in routine healthcare services.(1) The interplay between COVID-19 and glycemic control is particularly concerning, as studies have documented a rise in new-onset diabetes as well as worsening of pre-existing glycemic parameters post-infection.(2)

The marker Hemoglobin A1c (HbA1c) is considered as a marker to understand the glycemic control in the past 3 months. Elevated HbA1c levels post-COVID suggest an increased burden of hyperglycemia, potentially due to direct viral effects, prolonged inflammation, medication-related metabolic disturbances (such as corticosteroid-induced hyperglycemia), and reduced access to diabetes care during the pandemic .(3) Similarly, Random Blood Glucose (RBG) measurements have been widely used in epidemiological studies to assess glycemic trends in populations.

The National Family Health Survey (NFHS-4) from India has shown that approximately 12% women and 14% men aged 15 years and above had RBG levels exceeding 140 mg/dL .(4) During the COVID-19 pandemic, studies reported an increased prevalence of hyperglycemia due to a combination of factors, including stress-related hormonal changes, cytokine-induced insulin resistance, and modifications in diabetes treatment regimens .(5) Furthermore, lockdown-related lifestyle changes, such as reduced physical activity, dietary modifications, and mental health stressors, likely contributed to worsening glycemic control.

Given these observations, we hypothesized a 15% increase in the prevalence of elevated HbA1c and RBG levels among individuals aged 25 years and above in the post-COVID-19 period compared to pre-pandemic levels. The aim of the study was to assess and compare glycemic trends across different age groups and genders by analyzing retrospective hospital-based data from a medical college in Ramanagara, Karnataka. The findings is intended to provide valuable insights into the long-term metabolic consequences of the COVID-19 pandemic which will help inform future diabetes screening and management strategies in resource-limited settings. We conducted the study with these objectives (a) To compare burden of elevated RBG and HbA1c levels in individuals aged above 25 years during the pre COVID-19 and post COVID-19 periods (b) To analyze gender-wise and age-wise distribution of hyperglycemia trends over these two time periods.

MATERIAL & METHODS

Study Setting: The study was conducted at CDSIMER Hospital, Harohalli in Ramanagara District, Karnataka, a tertiary care medical college hospital that provides healthcare services to a diverse population, including both urban and rural communities. The hospital has a well-established Laboratory Information System (LIS) that records biochemical parameters, including HbA1c and Random Blood Glucose (RBG) levels, allowing for reliable retrospective data collection.

Study Design: A retrospective observational study design was used to compare HbA1c and RBG levels in patients aged above 25 years who attended CDSIMER Hospital during two distinct periods: pre COVID-19 period from January 2018 to December 2019 and the post COVID-19 period from January 2021 to December 2023. Data from the year 2020 will be excluded to minimize confounding effects arising from acute COVID-19 infections, pandemic-related healthcare disruptions, and the widespread use of corticosteroids, which may have transiently altered glycemic levels.

Source of Data: The primary source of data for this study was the Laboratory Information System (LIS) maintained by the Department of Biochemistry at CDSIMER Hospital, which contains electronic records of all biochemical investigations. Additionally, publicly available datasets such as the National Family Health Survey-5 (NFHS-5), conducted between 2019 and 2021, will be accessed to provide population-level estimates for comparison. Previous studies that are freely available on government and research websites will also be reviewed to contextualize glycemic trends before and after the COVID-19 pandemic.

Study Population: The study included all individuals aged above 25 years of age who have recorded HbA1c and RBG values in their medical records during the specified study periods. Patients with incomplete or missing medical records, particularly those without documented HbA1c or RBG values, were excluded. Additionally, individuals with conditions that could acutely alter HbA1c levels, such as hemolytic anemia or recent blood transfusions, were not considered for the analysis to ensure accuracy and consistency in the results.

Sample Size: A study conducted by Jaideep Khare et al., was relied on for sample size calculation, it reported that the proportion of individuals aged above 25 years with elevated HbA1c was 7% in the pre COVID-19 period and 8% in the post COVID-19 period, reflecting a relative increase of 15%. The sample size was calculated with 95% confidence interval, power of 80%, and a case-to-control ratio of 1:1, the estimated sample size was calculated to be 10,475 individuals. The sample size was determined using OpenEpi, an open-source epidemiological statistical software.

Data Collection: Data collection involved retrieving relevant laboratory records from the LIS at CDSIMER Hospital after obtaining necessary approvals from hospital authorities. The NFHS-5 reports were accessed through its official website which is freely available. All extracted data were

compiled and organized in Microsoft Excel for initial processing, followed by data cleaning and curation to ensure completeness and accuracy before statistical analysis.

Data Analysis: The STATA BE 17 statistical software (Serial number: 301706309069) was used to analyze the data. The primary outcome measures included the proportion of individuals with elevated RBG, categorized as values exceeding 140 mg/dL and 160 mg/dL, as well as the proportion of individuals with elevated HbA1c, defined as ≥6.5% for diabetes. Comparative analysis of proportion of hyperglycemia between the pre- and post-COVID-19 periods was conducted using chi-square tests to assess statistical significance.

Ethics Considerations: Ethics approval for the study was obtained from the Institutional Review Board (IRB) of CDSIMER before data collection. Since the research involves retrospective analysis of existing medical records, an informed consent waiver was sought. To ensure patient confidentiality, all data were anonymized before analysis, and the study was strictly adhered to ethical guidelines governing the use of retrospective clinical data.

RESULTS

Post-COVID burden of High (141–159 mg%) and Very High RBG Levels (>160 mg%)

In the post-COVID period, the proportion of very high levels (>160 mg%) was observed in 16.95% (95% CI: 16.40–17.50) of the overall study population (2922 out of 17,238 individuals) (Table 1 and 2) It was notably higher among males, with 22.15% (95% CI: 21.20–23.10, 1680/7583), compared to females, where the proportion was 12.86% (95% CI: 12.21–13.54, 1242/9655). (Table 3 and 4)

For high levels (141–159 mg%), the overall proportion was 5.4% (95% CI: 5.0–5.74, 931/17,238). Among males, 6.35% (95% CI: 5.82–6.92, 482/7583) had high levels, whereas in females, the proportion was 4.65% (95% CI: 4.24–5.08, 449/9655).

Table 1: Study population stratified by age and gender (N=17,238)

Age	Female (%)	Male (%)	Total (%)
25-35	3,450 (67.95)	1,627 (32.05)	5,077 (100)
36-45	2,199 (56.72)	1,678 (43.28)	3,877 (100)
46-55	1,590 (54.10)	1,349 (45.90)	2,939 (100)
56-65	1,124 (47.41)	1,247 (52.59)	2,371 (100)
66-75	934 (44.18)	1,180 (55.82)	2,114 (100)
76-85	303 (39.82)	458 (60.18)	761 (100)
>86	55 (55.56)	44 (44.44)	99 (100)
Total	9,655 (56.01)	7,583 (43.99)	17,238 (100)

Table 2: Study population stratified by RBG levels (N=17,238)

Age	Normal (%)	High RBG (%)	V High RBG (%)	Total (%)
25-35	4,658 (91.75)	169 (3.33)	250 (4.92)	5,077 (100)
36-45	3,099 (79.93)	182 (4.69)	596 (15.37)	3,877 (100)
46-55	2,079 (70.74)	172 (5.85)	688 (23.41)	2,939 (100)
56-65	1,516 (63.94)	192 (8.10)	663 (27.96)	2,371 (100)
66-75	1,463 (69.21)	146 (6.91)	505 (23.89)	2,114 (100)
76-85	510 (67.02)	62 (8.15)	189 (24.84)	761 (100)
>86	60 (60.61)	8 (8.08)	31(31.31)	99 (100)
Total	13,385 (77.65)	931 (5.40)	2,922 (16.95)	17,238 (100)

Table 3: Study population stratified by RBG levels among Males (N=7,583)

Age (Males)	Normal (%)	High RBG(%)	V High RBG(%)	Total(%)
25-35	1,420 (87.28)	78(4.79)	129 (7.93)	1,627 (100)
36-45	1,208(71.99)	93(5.54)	377 (22.47)	1,678 (100)
46-55	875(64.86)	83(6.15)	391 (28.98)	1,349 (100)
56-65	754(60.47)	101(8.10)	392 (31.44)	1,247 (100)
66-75	818(69.32)	90(7.63)	272 (23.05)	1,180 (100)
76-85	317(69.21)	35(7.64)	106 (23.14)	458 (100)
>86	29(65.91)	2(4.55)	13 (29.55)	44 (100)
Total	5,421(71.49)	482(6.36)	1,680 (22.15)	7,583 (100)

Table 4: Study population stratified by RBG levels among Females (N=9,655)

Age(Females)	Normal (%)	High RBG(%)	V High RBG(%)	Total(%)
25-35	3,238 (93.86)	91 (2.64)	121 (3.51)	3,450 (100)
36-45	1,891(85.99)	89 (4.05)	219 (9.96)	2,199 (100)
46-55	1,204 (75.72)	89 (5.60)	297 (18.68)	1,590 (100)
56-65	762 (67.79)	91 (8.10)	271 (24.11)	1,124 (100)
66-75	645 (69.06)	56 (6.00)	233 (24.95)	934 (100)
76-85	193 (63.70)	27 (8.91)	83 (27.39)	303 (100)
>86	31 (56.36)	6 (10.91)	18 (32.73)	55 (100)
Total	7,964 (82.49)	449 (4.65)	1,242 (12.86)	9,655 (100)

Comparison with NFHS-5 Data

When compared with data from NFHS-5, the proportion of very high levels (≥160 mg%) was lower among the general population before COVID-19 pandemic. In NFHS-5, 7.2% of males had very high levels, with high proportion in urban settings (8.5%) than in rural settings (6.5%). Among females, 6.3% had very high levels, again showing an urban-rural disparity .(8.0% vs. 5.5%) The differences were found to be statistically significant.

For high levels (141–160 mg%), the NFHS-5 data showed an overall proportion of 7.3% in males (urban: 7.8%, rural: 7.0%) and 6.1% in females (urban: 6.7%, rural: 5.9%).

These findings suggest a marked increase in the burden of both very high and high levels post-COVID, particularly among males. The urban-rural disparities noted in NFHS-5 continue to highlight potential sociodemographic variations in these levels.

HbA1c Levels

Among the 10,166 patients aged >25 years for whom HbA1c data were available, nearly 64% (6,506 patients) had levels exceeding 6.5%, indicating a high proportion of dysglycemia across both genders. While HbA1c measurement was initially included in the NFHS-5 protocol, it was later dropped due to operational feasibility challenges.

DISCUSSION

Our study highlights a significant increase in the burden of both high (141–159 mg%) and very high (>160 mg%) levels in the post-COVID period, with notable differences across gender. Compared to NFHS-5 data, which was collected before the pandemic, the prevalence of very high levels has more than doubled in males (22.15% vs. 7.2%) and nearly doubled in females (12.86% vs. 6.3%). A similar trend is observed in high levels, suggesting a substantial shift in metabolic profiles post-COVID.

Several factors could explain this rise. The COVID-19 pandemic led to widespread disruptions in healthcare access, lifestyle changes, and increased metabolic dysfunction due to infection and its sequelae. Studies have shown that COVID-19 itself can induce long-term alterations in glucose metabolism, contributing to higher post-recovery levels.(6,7) Additionally, the impact of lockdowns, reduced physical activity, altered dietary patterns, and increased stress may have further exacerbated metabolic disorders .(8,9)

Gender differences observed in our study align with global patterns where males tend to have a higher prevalence of metabolic disorders.(10) The disparity may be influenced by biological differences in fat distribution, hormonal regulation, and behavioural factors such as smoking and alcohol consumption. However, the significant increase among females compared to NFHS-5 suggests additional contributing factors, possibly related to post-COVID hormonal changes, increased sedentary lifestyles, and variations in healthcare-seeking behaviour.(11)

The findings also highlight urban-rural differences, as seen in NFHS-5, where urban populations had a higher prevalence of high and very high levels compared to rural populations. This could be attributed to differences in diet, physical activity, and access to health services.(12) However, it is prudent to assess whether post-COVID period has widened these gaps, necessitating targeted public health interventions.

Furthermore, the high prevalence of HbA1c >6.5% in 64% of patients aged >25 years underscores the significant burden of dysglycemia. The decision to remove HbA1c assessment from NFHS-5 due to operational feasibility highlights a missed opportunity for nationwide metabolic health surveillance. Given the increasing prevalence of hyperglycaemia, reconsidering HbA1c as a routine measure in future national health surveys could provide good insights into the evolving magnitude of diabetes and prediabetes in India .(13)

CONCLUSION

To conclude, our study underscores the metabolic effect of COVID-19, with a substantial increase in high and very high levels post-pandemic. The findings highlight the need for enhanced screening,

lifestyle interventions, and reconsideration of HbA1c in national health surveys. Addressing these metabolic challenges will be crucial in mitigating the long-term consequences of the pandemic on public health.

Recommendation

The rising burden of hyperglycemia post-COVID highlights the need to strengthen routine screening for dysglycemia, especially among adults above 25 years. Integrating metabolic monitoring into post-COVID care, promoting community-based lifestyle interventions, and enhancing public awareness are essential. Reintroducing HbA1c measurement in national health surveys will support better tracking of metabolic trends and guide targeted prevention strategies.

Limitation of the Study

The study has several limitations. The patients attending the hospital were diverse and from various geographical areas; however, this does not make the sample representative of the general population. As a result, the findings could be subject to selection bias. Additionally, the data may include multiple tests conducted on the same patients, potentially inflating prevalence estimates. Furthermore, NFHS-5 introduced blood glucose level estimation for the first time, and there is no data available for comparison with NFHS-4. This lack of historical data limits the ability to assess long-term trends in metabolic health before the pandemic.

Our study findings has the following public health implications. The rising burden of metabolic abnormalities post-COVID calls for urgent public health action. Strengthening routine screening for dysglycemia, particularly in high-risk groups such as males and urban populations, should be prioritized. Additionally, integrating metabolic health monitoring into post-COVID follow-up programs could help identify at-risk individuals early. Lifestyle interventions, including targeted programs for weight management, modifications in diet, and good physical activity, need to be emphasized at both the community and healthcare levels. Policymakers should also consider reintroducing HbA1c screening in future health surveys to enable better tracking of metabolic trends and inform intervention strategies.

Relevance of the Study

This study provides timely evidence on the substantial rise in hyperglycemia among adults in the post-COVID period, demonstrating a much higher burden than previously reported in national surveys. By comparing pre- and post-pandemic glycemic trends using real-world hospital data, it highlights the long-term metabolic consequences of COVID-19 and identifies high-risk groups requiring targeted interventions. The findings underscore the need to strengthen routine metabolic screening, integrate post-COVID metabolic follow-up into health services, and reconsider HbA1c monitoring in national surveys thereby contributing important insights for public health planning and diabetes prevention.

Authors Contribution

SMK conceived the study, developed the overall study design, and provided methodological guidance throughout the project. SMK, LLK and AS were responsible for data retrieval, data verification, and ensuring the completeness and quality of all extracted information. SBN conducted the statistical analysis, interpreted the results, and contributed to data visualisation. SMK and SBN drafted the initial version of the manuscript, while LLK and AS contributed to critical revisions and intellectual refinement of the content. All authors reviewed, contributed to, and approved the final manuscript.

Financial Support and Sponsorship

No financial support

Conflict of Interest

We declare no conflict of interest

Acknowledgement

Nil

Declaration of Generative AI and AI Assisted Technologies in the Writing Process

We have not used any generative AI and AI assisted technologies in the writing process

References

1. Apicella M, Campopiano MC, Mantuano M, Mazoni L, Coppelli A, Del Prato S. COVID-19 in people with diabetes: understanding the reasons for worse outcomes. *Lancet Diabetes Endocrinol.* 2020;8(9):782-92.
2. Montefusco L, Ben Nasr M, D'Addio F, Loretelli C, Rossi A, Pastore I, et al. Acute and long-term disruption of glycometabolic control after SARS-CoV-2 infection. *Nat Metab.* 2021;3(6):774-85.
3. Rubino F, Amiel SA, Zimmet P, Alberti G, Bornstein S, Eckel RH, et al. New-onset diabetes in COVID-19. *N Engl J Med.* 2020;383(8):789-90.
4. International Institute for Population Sciences (IIPS), ICF. *National Family Health Survey (NFHS-4), 2015–16: India.*Mumbai: IIPS; 2017. Available

from: https://dhsprogram.com/publications/publication-fr339-dhs-final-reports.cfm (accessed on 25 Aug 25)
5. Unnikrishnan R, Misra A, Yadav R. COVID-19 and diabetes: Risks, mechanisms and management strategies. *Diabetes Metab Syndr.* 2021;15(4):102176.
6. Montefusco L, Ben Nasr M, D'Addio F, et al. Acute and long-term disruption of glycometabolic control after SARS-CoV-2 infection. *Nat Metab.* 2021;3(6):774-85.
7. Sathish T, Cao Y. Is new-onset diabetes after COVID-19 part of post-COVID-19 syndrome? *Diabetes Metab Syndr.*2021;15(4):102-4.
8. Cummings JL, Morstatter F, Vyas A. The impact of the COVID-19 pandemic on dietary habits and physical activity in India. *J Public Health Res.* 2022;11(2):230-5.
9. Lim S, Bae JH, Kwon HS, Nauck MA. COVID-19 and diabetes mellitus: from pathophysiology to clinical management. *Nat Rev Endocrinol.* 2021;17(1):11-30.
10. Klein S, Flanagan KL. Sex differences in immune responses. *Nat Rev Immunol.* 2016;16(10):626-38.
11. Ding T, Zhang J, Wang T, et al. Gender differences in metabolic syndrome and its components among Chinese adults: a longitudinal study. *BMC Public Health.* 2021;21(1):31.
12. Gupta R, Gaur K, Sahoo AK. Urban-rural disparities in diabetes prevalence and risk factors in India: a systematic review. *J Diabetes Res.* 2022;2022:1-12.
13. Anjana RM, Deepa M, Pradeepa R, et al. Prevalence of diabetes and prediabetes in urban and rural India: Phase I results of the Indian Council of Medical Research–INdia DIABetes (ICMR–INDIAB) study. *Diabetologia.*2011;54(12):3022-7.