RESEARCH ARTICLE

Prevalence of Diabetes Mellitus Complications: Burden and Risks in the South Indian Population

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ABSTRACT

Type 1 Diabetes Mellitus (T1DM) is a persistent metabolic condition marked by elevated blood glucose levels, with a global increase in prevalence and associated complications. This study investigated the occurrence and impact of diabetes-related complications, including cardiovascular, renal, ocular, neuropathic, and hypoglycemic events, among patients at a tertiary care center in South India. Over 1.5 years, 353 individuals with T1DM were assessed using a prospective observational design. Data analysis was conducted using SPSS version 24.

The participants' average age was 46.1±10.8 years, with most being male (69.97%) and from rural areas (58.92%). Post-intervention data showed significant improvements, such as a reduction in HbA1c levels from 7.7±0.6% to 6.9±0.4% and lower smoking and alcohol consumption rates. Cardiovascular issues were most common, with hypertension (31.16%), stroke (23.23%), and myocardial infarction (20.68%) leading. Renal complications like nephropathy (13.03%) and end-stage renal disease (11.90%) were also prominent. Infected foot ulcers (18.70%), neuropathy (18.70%), and depression (33.14%) were notable comorbidities. Hypoglycemic episodes highlighted the need for better glycemic regulation.

The findings emphasize the need for comprehensive care strategies, including early diagnosis, tailored risk management, and lifestyle modifications. Multidisciplinary approaches integrating physical and mental health interventions are crucial for mitigating complications and improving outcomes in T1DM patients. Targeted efforts are essential to address the unique challenges faced by high-risk groups. Further research is required to enhance preventive and therapeutic strategies for managing diabetes complications effectively.

Keywords: Diabetes Mellitus, Complications, Cardiovascular, Glycemic Control.

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INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia due to either insufficient insulin production or impaired insulin utilization. It is a major public health concern with significant morbidity, mortality, and economic implications. Diabetes mellitus is broadly categorized into T1DM, T2DM, gestational diabetes, and specific types due to other causes such as monogenic diabetes syndromes or diseases of the exocrine pancreas. Each type has unique pathophysiological mechanisms, risk factors, and management strategies[1]. Emerging complications associated with DM, including cardiovascular disease, neuropathy, nephropathy, and retinopathy, exacerbate its impact on individuals and healthcare systems. These complications often result from prolonged uncontrolled glucose levels, oxidative stress, and inflammation[1,2]. The rising prevalence of DM and its associated complications necessitate urgent global attention[3]. The prevalence of DM has risen dramatically over the past decades, affecting over 537 million adults worldwide in 2021. This figure is expected to reach 783 million by 2045. Diabetes mellitus constitutes approximately 90-95% of all cases, with a higher burden in low- and middle-income countries[4]. The annual global incidence of DM continues to grow, with an estimated 1.5 million new cases diagnosed in the United States alone in 2022[5]. While T2DM predominates in adults, type 1 diabetes mellitus (T1DM) shows increasing incidence among children and adolescents[6].DM is associated with a myriad of co-morbid conditions, including hypertension, dyslipidemia, and obesity, which collectively heighten the risk of cardiovascular complications. Long-term complications such as diabetic retinopathy, nephropathy, neuropathy, and peripheral arterial disease severely impair quality of life. Emerging evidence also links DM to non-traditional complications like cognitive decline, hearing loss, and non-alcoholic fatty liver disease[7,8]. Diagnosis of DM is established through laboratory criteria, including fasting plasma glucose (≥126 mg/dL), 2-hour plasma glucose during an oral glucose tolerance test (≥200 mg/dL), glycated hemoglobin (HbA1c ≥6.5%), or random plasma glucose levels in symptomatic individuals (≥200 mg/dL). Early diagnosis is critical to delay or prevent complications. The effectiveness of DM management depends on comprehensive care involving glycemic control, lifestyle modifications, and

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pharmacotherapy. The primary goals of DM treatment are to achieve glycemic targets, prevent or delay complications, and improve quality of life. Personalized treatment plans addressing individual risk factors and co-morbidities are essential to optimize outcomes. The treatment journey for DM begins with lifestyle interventions such as dietary modifications, exercise, and weight management. As the disease progresses, pharmacological agents, including oral antidiabetics and insulin therapy, are introduced. Regular monitoring and timely adjustments are critical to ensure optimal glycemic control. Physical impairments due to DM complications can range from vision loss in retinopathy to mobility issues from neuropathy and amputation. These impairments significantly reduce independence and increase reliance on caregivers[8-11]. DM imposes a substantial economic burden on individuals and healthcare systems. Direct costs include medical care, medications, and hospitalizations, while indirect costs stem from lost productivity and premature mortality. In 2021, global healthcare spending on DM reached approximately $966 billion[12]. The data underscores the high burden of complications among individuals with diabetes, with cardiovascular issues, depression, and hypoglycemia being particularly prominent. These findings highlight the critical need for comprehensive management strategies to mitigate the risk of both acute and chronic complications in this population. This study examined the prevalence of diabetes-related complications, identifying high rates of cardiovascular, renal, retinopathy, neuropathy, foot ulcer, and hypoglycemic events among participants. The results emphasize the substantial burden of these issues and highlight the urgent need for strategies to address acute and long-term risks in this population. The research contextualises observed patterns and trends by comparing these findings with prior studies, offering insights into effective intervention approaches.

METHODOLOGY

The study was conducted at a tertiary care hospital in South India using a prospective, observational, pharmacoeconomic research design. It spanned 1.5 years to facilitate comprehensive data collection and analysis. Ethical approval was obtained (Reg. No: ECR/1049/INST/AP/2018/RR-21, IEC Ref No. IEC/2021/078GM/SAH). A patient-tracking log form was utilized to document participant registration while ensuring confidentiality and adherence to privacy guidelines.

A total of 353 participants were enrolled based on specific inclusion criteria. Eligible individuals were adults (18 years or older) who provided informed consent, had a confirmed diagnosis of type 1 diabetes mellitus (T1DM), had been on human insulin therapy for a minimum of 12 months before enrollment, and had at least one recorded HbA1c value in their medical records within the past year. Exclusion criteria included individuals diagnosed with type 2 diabetes mellitus (T2DM), gestational diabetes, chronic pancreatitis, or latent autoimmune diabetes in adults, as well as those unwilling to participate.

After data collection, statistical analysis was conducted using SPSS version 24. Descriptive statistics were applied to summarize the data and endpoint measures, including the number of participants, mean, median, minimum and maximum values, and standard deviation for continuous variables.

Table 1: Rates of complications in study participants (n = 353)

Baseline cardiovascular complications	N	%
Hypertension	110.00	31.16
Myocardial Infarction	73.00	20.68
Angina pectoris	17.00	4.82
Peripheral vascular disease	35.00	9.92
Stroke	82.00	23.23
Congestive Heart Failure	19.00	5.38
Atrial Fibrillation	16.00	4.53
Left Ventricular Hypertrophy	0.00	0.00
Baseline renal complications		
Nephropathic complications	46.00	13.03
End Stage Renal Disease (ESRD)	42.00	11.90
Baseline retinopathy complications		
Retinopathy complications	4.00	1.13
Severe vision loss	15.00	4.25
Cataract	0.00	0.00
Macular edema	0.00	0.00
Baseline foot ulcer complications		
Infected ulcer	66.00	18.70
Uninfected ulcer	0.00	0.00
History of amputation	20.00	5.67
Healed Ulcer	0.00	0.00
Baseline Neuropathy		
Neuropathy	66.00	18.70
Depression	117.00	33.14
Hypoglycaemic complications		
Mild	75.00	21.25
Moderate	40.00	11.33
Severe	30.00	8.50

RESULTS

The baseline characteristics of the study participants (n = 353). The mean age of participants was 46.1±10.8 years, with a higher proportion of males (69.97%) compared to females (30.03%). A significant majority (91.22%) of participants were married, with only 8.78% identifying as single, widowed, or separated. Regarding religious distribution, 77.05% of participants were Hindu, followed by 14.16% Muslim and 8.78% Christian.

In terms of education, a large proportion of participants (37.96%) were illiterate, while 21.53% had completed high school. Only a small fraction (1.70%) had postgraduate education. Most participants resided in rural areas (58.92%) and belonged to lower-income groups, with 58.36% earning less than 5 lakhs annually.

The mean duration of diabetes was 10.1±5.4 years, with a similar mean for years since insulin initiation (10.0±5.5 years). Risk factor analysis revealed substantial improvements following treatment interventions. The mean HbA1c level decreased from 7.7±0.6% at baseline to 6.9±0.4% after treatment, indicating an incremental improvement of 0.8±0.4%. Systolic and diastolic blood

pressure values also improved significantly, with reductions of 21.5±9.2 mmHg and 11.8±5.7 mmHg, respectively.

Behavioural factors showed noteworthy changes; the proportion of smokers reduced from 51.27% at baseline, and alcohol consumption decreased from 73 participants to 20.68% following intervention. These findings highlight the positive impact of treatment strategies on glycemic control, blood pressure, and behavioural modifications.

Cardiovascular Complications

The most prevalent cardiovascular complication was hypertension, observed in 31.16% of participants, followed by stroke (23.23%) and myocardial infarction (20.68%). Less frequent complications included peripheral vascular disease (9.92%), congestive heart failure (5.38%), atrial fibrillation (4.53%), and angina pectoris (4.82%). Notably, no participants presented with left ventricular hypertrophy.

Renal Complications

Renal complications were also significant, with nephropathic complications affecting 13.03% of participants and end-stage renal disease (ESRD) present in 11.90%.

Retinopathy Complications

Retinopathy-related issues were less common. Only 1.13% of participants exhibited general retinopathy complications, while 4.25% had severe vision loss. No cases of cataracts or macular edema were reported.

Foot Ulcer Complications

Foot ulcers were another critical issue, with infected ulcers identified in 18.70% of participants. A history of amputation was noted in 5.67% of individuals. However, no cases of uninfected ulcers or healed ulcers were recorded.

Neuropathy

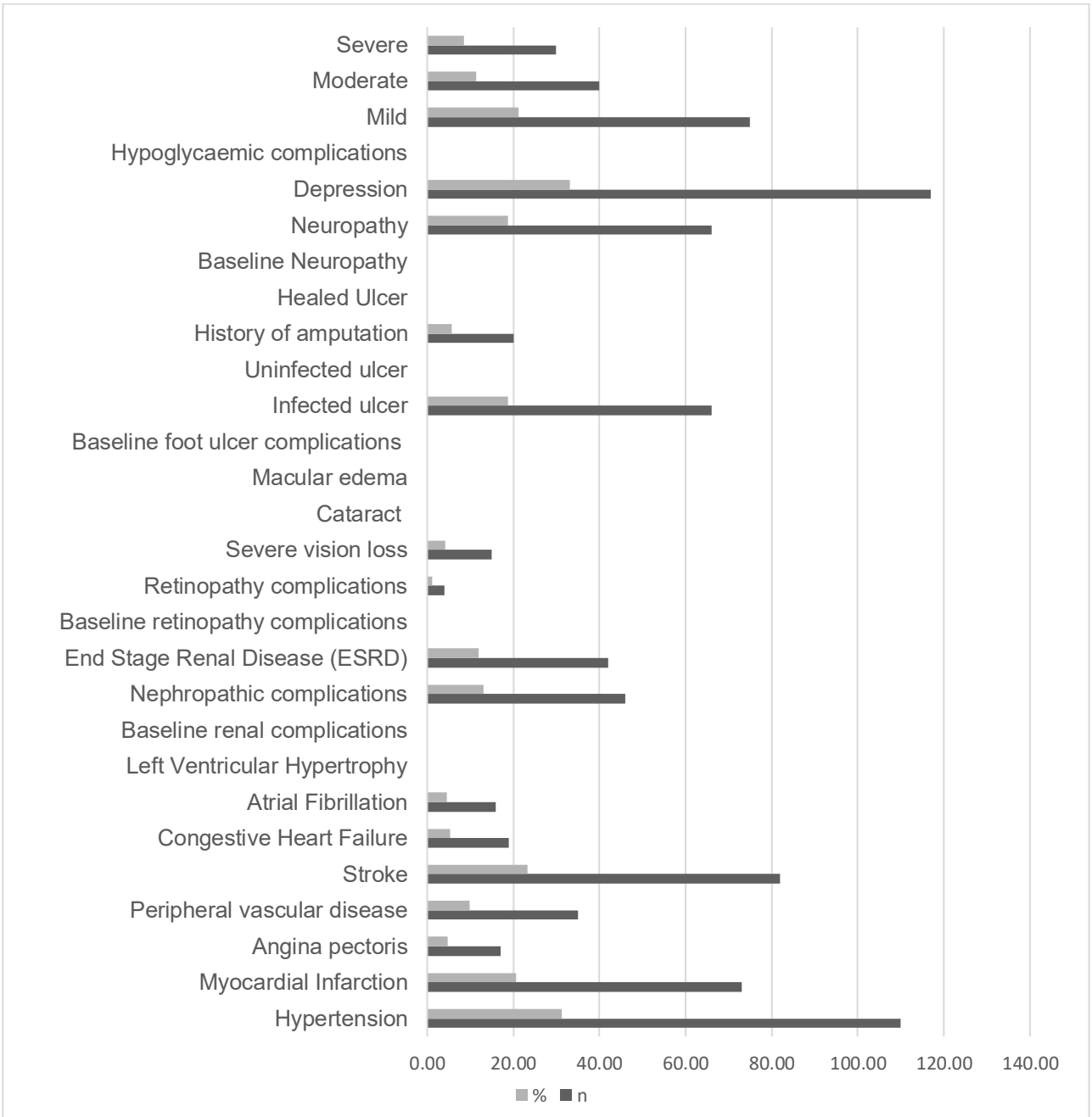

Figure 1: Rates of complications in study participants (n=353)

Neuropathy was reported in 18.70% of participants. Additionally, depression, a related comorbidity, was highly prevalent, affecting 33.14% of the cohort.

Hypoglycemic Complications

Hypoglycemic complications varied in severity. Mild hypoglycemia was the most common, affecting 21.25% of participants, followed by moderate hypoglycemia (11.33%) and severe hypoglycemia (8.50%).

The data underscores the high burden of complications among individuals with diabetes, with cardiovascular issues, depression, and hypoglycemia being particularly prominent. These findings highlight the critical need for comprehensive management strategies to mitigate the risk of both acute and chronic complications in this population.

DISCUSSION

This study evaluated the prevalence of various complications among study participants, revealing notable rates of cardiovascular, renal, retinopathy, foot ulcer, neuropathy, and hypoglycemic complications. These findings were compared with those reported in other studies to contextualize the observed trends and identify patterns. The prevalence of hypertension in our study was 31.16%, which aligns closely with other reported findings[13], who reported a prevalence of 30-35% among similar populations. However, our myocardial infarction rate (20.68%) is higher than the 15% observed in a study, potentially reflecting regional or demographic differences. Stroke prevalence in our cohort was 23.23%, slightly higher than the 20% reported in a article[14], possibly due to differences in sample size or baseline characteristics. Congestive heart failure (5.38%) and atrial fibrillation (4.53%) were less prevalent, consistent with a reported study[15], who noted a prevalence of under 10% for these complications in similar populations. Nephropathic complications were observed in 13.03% of participants, aligning with, where rates ranged between 12-14% in individuals with similar clinical profiles. However, end-stage renal disease (ESRD) was noted in 11.9% of participants, higher than the 8% reported in a study[16]. This discrepancy may be attributed to differences in access to healthcare or the stage of disease progression at enrolment. The prevalence of retinopathy complications (1.13%) in this study is significantly lower than the rates reported[17], which ranged between 3-5%. Similarly, severe vision loss was observed in 4.25% of participants, aligning with the upper range of values reported. The absence of cataracts and macular edema in our cohort differs from findings in an artcle[18], suggesting potential differences in screening criteria or population-specific risk factors. Infected ulcers were reported in 18.7% of participants, consistent with findings, where the prevalence was approximately 20%. Notably, there were no uninfected or healed ulcers in our study, contrasting, those who reported these conditions in 10% of cases. This variation could result from differences in treatment protocols or the study's cross-sectional design. History of amputation (5.67%) was comparable to the rates of 4-6% reported. Neuropathy affected 18.7% of participants, slightly lower than the 22% reported in a study. Depression, however, was highly prevalent (33.14%), exceeding the rates observed, which ranged from 20-30%. This difference underscores the importance of considering psychosocial factors when managing chronic conditions. Hypoglycemic complications were categorized as mild (21.25%), moderate (11.33%), and severe (8.5%). These rates align with findings, where mild and moderate complications were more frequent than severe episodes. The lower prevalence of severe hypoglycemia in our cohort might reflect improved glucose monitoring and management strategies.

Implications and Limitations

The observed rates highlight the multifaceted nature of complications in chronic conditions and emphasize the need for targeted interventions. Differences from other studies might be due to variations in study design, population demographics, or healthcare settings. Future research should consider longitudinal designs to better understand causal relationships and the progression of complications.

CONCLUSION

This study highlights the prevalence and burden of diabetes-related complications in participants, underscoring the need for comprehensive care. Cardiovascular complications such as hypertension (31.16%), stroke (23.23%), and myocardial infarction (20.68%) require focused risk management strategies. Renal issues, including nephropathy (13.03%) and end-stage renal disease (11.90%), emphasize the impact of chronic kidney disease. While retinopathy complications were less frequent (4.25%), infected foot ulcers (18.70%), neuropathy (18.70%), and depression (33.14%) highlight critical areas for intervention. Hypoglycemic episodes, though mostly mild or moderate, reinforce the importance of education and glucose monitoring. A multidisciplinary approach, combining early detection, lifestyle changes, education, and mental health support, is vital for mitigating these complications and improving outcomes. Further research is needed to tailor interventions for high-risk populations.

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REFERENCES

1. American Diabetes Association. Standards of medical care in diabetes—2022 abridged for primary care providers. Clinical Diabetes. 2022 Jan 1;40(1):10-38.
2. Sun H, Saeedi P, Karuranga S, Pinkepank M, Ogurtsova K, Duncan BB, Stein C, Basit A, Chan JC, Mbanya JC, Pavkov ME. IDF Diabetes Atlas: Global, regional, and country-level diabetes prevalence estimates for 2021

and projections for 2045: diabetes research and clinical practice. 2022 Jan 1; 183:109119.
3. International Diabetes Federation. Diabetes Atlas. 10th ed. 2023.
4. World Health Organization. World Health Organization Diabetes Fact Sheet. WHO: Geneva, Switzerland. 2011.
5. Herman WH, Schillinger D, Bolen S, Boltri JM, Bullock A, Chong W, Conlin PR, Cook IV JW, Dokun A, Fukagawa N, Gonzalvo J. The National Clinical Care Commission report to Congress: recommendations to better leverage federal policies and programs to prevent and control diabetes. Diabetes Care. 2023 Feb 1;46(2):255-61.
6. Patterson CC, Harjutsalo V, Rosenbauer J, et al. Trends and projections of childhood diabetes incidence. Diabetologia. 2023;66(1):12-22.
7. Ashcroft FM, Rorsman P. Diabetes mellitus and the β cell: the last ten years. Cell. 2012 Mar 16;148(6):1160-71.
8. Gregg EW, Sattar N, Ali MK. The changing face of diabetes complications. The lancet Diabetes & endocrinology. 2016 Jun 1;4(6):537-47.
9. Turbow SD, Uppal TS, Haw JS, Chehal P, Fernandes G, Shah M, Rajpathak S, Ali MK, Narayan KV. Trends and demographic disparities in diabetes hospital admissions: analyses of serial cross-sectional national and state data, 2008–2017. Diabetes Care. 2022 Jun 2;45(6):1355-63.
10. Seuring T, Archangelidi O, Suhrcke M. The economic costs of type 2 diabetes: a global systematic review. Pharmacoeconomics. 2015 Aug; 33:811-31.
11. Wiviott SD, Raz I, Bonaca MP, Mosenzon O, Kato ET, Cahn A, Silverman MG, Zelniker TA, Kuder JF, Murphy SA, Bhatt DL. Dapagliflozin and cardiovascular outcomes in type 2 diabetes. New England Journal of Medicine. 2019 Jan 24;380(4):347-57.
12. Neal B, Perkovic V, Mahaffey KW, De Zeeuw D, Fulcher G, Erondu N, Shaw W, Law G, Desai M, Matthews DR. Canagliflozin and cardiovascular and renal events in type 2 diabetes. New England Journal of Medicine. 2017 Aug 17;377(7):644-57.
13. Burnier M, Damianaki A. Hypertension as cardiovascular risk factor in chronic kidney disease. Circulation research. 2023 Apr 14;132(8):1050-63.
14. Sethi Y, Patel N, Kaka N, Kaiwan O, Kar J, Moinuddin A, Goel A, Chopra H, Cavalu S. Precision medicine and the future of cardiovascular diseases: a clinically oriented comprehensive review. Journal of Clinical Medicine. 2023 Feb 23;12(5):1799.
15. Joseph J, Varkey BP, Varghese A, Mathews E, Dhandapani M, Sharma SK, Shah S, Narasimha VL, Renjith V, Dhandapani S, Manjula GB. Age, gender, and regional variations in stroke epidemiology in India: A systematic review and meta-analysis. Indian Journal of Community and Family Medicine. 2024 Jan 1;10(1):7-17.
16. Ravender R, Roumelioti ME, Schmidt DW, Unruh ML, Argyropoulos C. Chronic Kidney Disease in the Older Adult Patient with Diabetes. Journal of Clinical Medicine. 2024 Jan 8;13(2):348.
17. Monaco WA, Crews JE, Nguyen AT, Arif A. Prevalence of vision loss and associations with age-related eye diseases among nursing home residents aged≥ 65 years. Journal of the American Medical Directors Association. 2021 Jun 1;22(6):1156-61.
18. Sharma S, Chaudhary P, Tomar VP, Singh R, Chaudhary SS, Jaiswal N, Gupta S, Kumar A. Prevalence of vision-threatening retinal conditions in patients referred for catract surgery from rural cataract camps: making the invisible visible. International Journal of Community Medicine and Public Health. 2021 Mar;8(3):1381.