Original Research Article

Prevalence of diabetes mellitus and its complications in rural areas a population based cross section al study

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Abstract
Background: Diabetes mellitus represents a growing public health concern worldwide, particularly in rural areas where healthcare access and education are often limited. Understanding the prevalence of diabetes and its associated complications in these settings is crucial for developing targeted interventions. **Objective:** This study aims to assess the prevalence of diabetes mellitus and its common complications in a rural population. **Methods:** We conducted a cross-sectional study involving a sample of 200 adults from rural regions. Participants were screened for diabetes mellitus using fasting blood glucose and oral glucose tolerance tests. The presence of diabetes-related complications such as neuropathy, retinopathy, nephropathy, cardiovascular diseases, and peripheral vascular disease was also assessed. **Results:** The prevalence of diabetes in the study population was found to be 20%, with pre-diabetes detected in 30% of the participants. Significant complications identified included cardiovascular disease (50%), neuropathy (45%), retinopathy (30%), peripheral vascular disease (20%), and nephropathy (25%). Statistical analyses revealed significant associations between diabetes and several complications, with odds ratios indicating a higher likelihood of developing these conditions compared to non-diabetic individuals. **Conclusion:** The high prevalence of diabetes and its complications in the rural population studied highlights a critical need for enhanced diagnostic facilities, better healthcare access, and increased education about diabetes management and prevention. Public health efforts should focus on these areas to mitigate the impact of diabetes in rural communities.
Keywords: Diabetes Mellitus, Rural Health, Complications of Diabetes

Introduction
Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels, which, over time, leads to serious damage to the heart, blood vessels, eyes, kidneys, and nerves. The global prevalence of diabetes has been rising more sharply in middle- and low-income countries, where rural communities are often the hardest hit due to limited access to healthcare services, diagnostic facilities, and awareness about the disease.[1]

Rural populations are particularly vulnerable to the burdens of diabetes due to factors such as lower socioeconomic status, poorer health literacy, and limited access to healthcare resources. These factors contribute not only to a higher incidence of diabetes but also to an increased prevalence of complications associated with the disease. Moreover, the rural healthcare infrastructure often lacks the capacity to manage chronic diseases, which leads to underdiagnosis and underreporting.[2] Despite the significant impact of diabetes in rural settings, data on the prevalence of diabetes and its associated complications in these areas remain sparse. This gap in knowledge hinders effective public health strategies aimed at reducing the burden of diabetes in rural populations. Hence, there is a critical need for comprehensive studies that provide clear insights into the epidemiology of diabetes and its long-term effects in these underserved communities.[3]

Aim
To determine the prevalence of diabetes mellitus and its complications in a rural population.

Objectives
1. To estimate the prevalence of diabetes mellitus in the rural population.
2. To identify the common complications associated with diabetes in this demographic.
3. To analyze factors influencing the management and outcome of diabetes in rural areas.

Material and Methodology
Source of Data
The data for this study were collected from residents of a rural area located in the region known for agricultural activities.
Study Design
This was a cross-sectional study designed to assess the prevalence and complications of diabetes mellitus among the rural population.
Study Location
The study was conducted in a rural district with limited access to healthcare facilities, primarily reliant on agriculture.
Study Duration
The duration of the study was from January 2023 to December 2023.
Sample Size
The total sample size for this study was 200 individuals selected through a stratified sampling technique to ensure representation across various demographic groups.
Inclusion Criteria
Participants included were adults aged 18 years and older, residing in the study area for at least one year prior to the commencement of the study.
Exclusion Criteria
Excluded from the study were individuals with pre-existing endocrine disorders other than diabetes, those unwilling to participate, and pregnant women due to the temporary changes in glucose metabolism during pregnancy.
Procedure and Methodology
Participants were initially screened through a questionnaire to gather demographic data and medical history, followed by a physical examination. Blood samples were collected from fasting individuals to measure baseline glucose levels, and an oral glucose tolerance test (OGTT) was conducted for those without a prior diabetes diagnosis.

Sample Processing
Blood samples were analyzed using standardized biochemical methods in a central laboratory to ensure consistency in glucose measurements.
Statistical Methods
Data were analyzed using SPSS software. Descriptive statistics were used to estimate the prevalence, and logistic regression models were applied to identify predictors of diabetes and its complications.
Data Collection
Data collection involved face-to-face interviews, physical examinations, and laboratory tests conducted by trained healthcare professionals. Data integrity was maintained through regular audits and cross-verification of the collected data by the study supervisors.

Observation and Results:
Table 1: Prevalence of Diabetes Mellitus in the Rural Population

Variable	n (200)	Percentage (%)
Pre-diabetes	60	30
Diabetes	40	20

Table 1 presents data on the prevalence of pre-diabetes and diabetes within a rural population of 200 individuals. It indicates that 30% of the participants, or 60 individuals, are classified as pre-diabetic, while 20% or 40 individuals have been diagnosed with diabetes.

Table 2: Common Complications Associated with Diabetes in this Demographic

Complication	n (40)	Percentage (%)	Odds Ratio (OR)	95% CI	P Value
Retinopathy	12	30	2.5	[1.3-4.7]	<0.05
Neuropathy	18	45	3.0	[1.9-4.8]	<0.01
Nephropathy	10	25	1.5	[0.6-3.7]	0.18
Cardiovascular Disease	20	50	2.8	[1.6-5.0]	<0.05
Peripheral Vascular Disease	8	20	3.2	[1.7-5.8]	<0.01

Table 2 details the prevalence of various diabetes-related complications among 40 diagnosed diabetic patients. Neuropathy appears to be the most common complication, affecting 45% of the diabetic patients, followed by cardiovascular disease impacting 50%. Retinopathy and peripheral vascular disease are observed in 30% and 20% of the patients, respectively, while nephropathy is present in 25%. The odds ratios (OR) indicate the likelihood of these complications compared to the baseline risk in this population, with neuropathy showing a significant association with an OR of 3.0 (95% CI: [1.9-4.8], $p<0.01$). Similarly, retinopathy and cardiovascular disease have significant ORs of 2.5 and 2.8, respectively, with corresponding p-values indicating statistical significance (<0.05). Peripheral vascular disease also shows a significant risk increase with an OR of 3.2. In contrast, nephropathy's association is not statistically significant (OR: 1.5, 95% CI: [0.6-3.7], $p=0.18$), suggesting its prevalence might be influenced by other factors not captured in this data.

Discussion:
Table 1 shows that 30% of the population is pre-diabetic, while 20% have been diagnosed with diabetes. The prevalence of diabetes in this study is considerably high, reflecting a growing trend seen in other rural studies globally. A study by Boadu WI et al. (2023)[4] & Foss R et al. (2023)[5]

reported a rising trend of diabetes prevalence in rural China, attributing it to urbanization and lifestyle changes. Similarly, research in rural India found a prevalence rate nearing 13%, highlighting the expansion of the diabetes epidemic beyond urban areas Diawara A et al. (2023)[6] & Abdul Basit K et al. (2023)[7]. The 20% prevalence rate in this study underscores a critical need for effective diabetes prevention and management strategies in rural settings.

Table 2, The high prevalence rates of complications such as neuropathy (45%), cardiovascular disease (50%), and retinopathy (30%) among diabetic patients are alarming but consistent with global data. Studies have shown that diabetic complications are a major burden, particularly in areas with inadequate healthcare services. A study conducted in rural areas of the U.S. found similar trends in complications, emphasizing the role of healthcare accessibility in managing diabetes Ma X et al. (2023)[8] & Puig-García M et al. (2023)[9]. The significant odds ratios for neuropathy, cardiovascular disease, and peripheral vascular disease in this study highlight the severe impact of diabetes on rural health, necessitating urgent public health interventions.

The lack of significance in the association of nephropathy (OR: 1.5, p=0.18) might be influenced by the smaller sample size or the stage at which the diagnosis occurs, often later in rural settings due to less frequent medical screenings Alnaim MM et al. (2023)[10] & Kansra P et al. (2023)[11].

Conclusion:

This population-based cross-sectional study has illuminated the significant challenge posed by diabetes mellitus and its complications in rural areas. With a prevalence rate of 20% for diabetes and 30% for pre-diabetes among the surveyed population, it is evident that diabetes is a major public health concern in these regions. The substantial occurrence of associated complications—such as neuropathy in 45% of diabetic patients, cardiovascular diseases in 50%, retinopathy in 30%, and peripheral vascular disease in 20%—further underscores the severity of the situation.

These findings reveal a critical need for enhanced diabetes awareness, better diagnostic facilities, and more accessible treatment options in rural settings. The high rates of complications indicate that diabetes management in these areas is often delayed or inadequate, leading to severe health outcomes. This study emphasizes the necessity for targeted public health interventions, including education on lifestyle modifications, regular screening programs to detect diabetes early, and improved healthcare services tailored to meet the needs of rural populations.

Moreover, the disparity in healthcare access between rural and urban areas necessitates an integrative approach that includes building healthcare infrastructure, training healthcare professionals who can work in rural settings, and implementing community-based programs to educate residents about diabetes prevention and care.

In conclusion, tackling diabetes in rural areas requires a multifaceted strategy that not only focuses on improving healthcare delivery and infrastructure but also on empowering communities with the knowledge and resources needed to manage and prevent diabetes effectively. This study provides valuable insights that could guide policy makers and health practitioners in designing and implementing such strategies to reduce the burden of diabetes in rural populations.

Limitations of Study:

1. **Cross-sectional Design**: The inherent nature of a cross-sectional study limits the ability to establish causality between risk factors and diabetes or its complications. This type of study only provides a snapshot in time, making it challenging to determine the sequence of events or the progression of the disease and its complications.

2. **Sampling Methodology**: While efforts were made to ensure a representative sample of the rural population, the sampling method may still introduce selection bias. The use of non-random sampling techniques or the exclusion of certain demographics could affect the generalizability of the findings to all rural areas.

3. **Self-reported Data**: Some of the data, particularly regarding lifestyle factors and previous medical history, were obtained through self-reports, which are prone to recall bias and may not always be accurate. This can lead to misclassification of disease status or an underestimation of certain risk factors.

4. **Limited Access to Diagnostic Facilities**: Given the rural setting of the study, there may have been limited access to advanced diagnostic facilities, which could affect the accuracy of diagnosing diabetes and its complications. This limitation might lead to underdiagnosis or misdiagnosis, particularly of less obvious complications such as neuropathy or early-stage nephropathy.

5. **Geographical Variation**: The results are specific to the rural area studied and may not be applicable to other rural regions with different socioeconomic statuses, healthcare access, and cultural practices affecting health behavior and disease management.

6. **Lack of Longitudinal Data**: The study does not provide longitudinal data, which is crucial for understanding the dynamics of diabetes and its complications over time. Longitudinal studies would allow for a better assessment of incidence rates and progression patterns of the disease and its complications.

7. **Control Variables**: The study may not have accounted for all potential confounding variables that can influence the prevalence of diabetes and its complications, such as genetic predispositions, detailed dietary patterns, and other environmental factors unique to the rural setting.

References:

1. Ghassab-Abdollahi N, Nadrian H, Pishbin K, Shirzadi S, Sarbakhsh P, Saadati F, Moradi MS, Azar PS, Zhianfar L. Gender and urban–rural residency based differences in the prevalence of type-2 diabetes mellitus and its determinants among adults in Naghadeh: Results of IraPEN survey. Plos one. 2023 Mar 7;18(3):e0279872.

2. Hou X, Wang L, Zhu D, Guo L, Weng J, Zhang M, Zhou Z, Zou D, Ji Q, Guo X, Wu Q. Prevalence of diabetic retinopathy and vision-threatening diabetic retinopathy in adults with diabetes in China. Nature Communications. 2023 Jul 18;14(1):4296.

3. Kousha A, Abbasian M, Saboktakin L, Nikanfar R, Hosseini N, Matlabi H. Major Diabetic Complications among Rural Population in Miandoab, Iran: a Community-Based Cross-Sectional Study. SN Comprehensive Clinical Medicine. 2023 Sep 7;5(1):220.

4. Boadu WI, Anto EO, Frimpong J, Ntiful F, Korsah EE, Ansah E, Tamakloe VC, Agyapomaa A, Opoku S, Senu E, Nyantakyi M. Prevalence, knowledge, and lifestyle-associated risk factors of dyslipidemia among Ghanaian type-2 diabetes mellitus patients in rural and urban areas: A multicenter cross-sectional study. Health Science Reports. 2023 Aug;6(8):e1475.

5. Foss R, Fischer K, Lampman MA, Laabs S, Halasy M, Allen SV, Garrison GM, Sobolik G, Bernard M, Sosso J, Thacher TD. Disparities in diabetes care: differences between rural and urban patients within a large health system. The Annals of Family Medicine. 2023 May 1;21(3):234-9.

6. Diawara A, Coulibaly DM, Hussain TY, Cisse C, Li J, Wele M, Diakite M, Traore K, Doumbia SO, Shaffer JG. Type 2 diabetes prevalence, awareness, and risk factors in rural Mali: a cross-sectional study. Scientific Reports. 2023 Mar 6;13(1):3718.
7. Abdul Basit K, Fawwad A, Mustafa N, Davey T, Tahir B, Basit A. Changes in the prevalence of diabetes, prediabetes and associated risk factors in rural Baluchistan; a secondary analysis from repeated surveys (2002–2017). Plos one. 2023 Apr 20;18(4):e0284441.
8. Ma X, Fan W, Zhang X, Zhang S, Feng X, Song S, Wang H. The urban-rural disparities and factors associated with the utilization of public health services among diabetes patients in China. BMC Public Health. 2023 Nov 20;23(1):2290.
9. Puig-García M, Caicedo-Montaño C, Márquez-Figueroa M, Chilet-Rosell E, Montalvo-Villacis G, Benazizi-Dahbi I, Peralta A, Torres-Castillo AL, Parker LA. Prevalence and gender disparities of Type 2 Diabetes Mellitus and obesity in Esmeraldas, Ecuador: A population-based survey in a hard-to-reach setting. International Journal for Equity in Health. 2023 Jul 1;22(1):124.
10. Alnaim MM, Alrasheed A, Alkhateeb AA, Aljaafari MM, Alismail A. Prevalence of microvascular complications among patients with type 2 diabetes mellitus who visited diabetes clinics in Saudi Arabia. Saudi Medical Journal. 2023 Feb;44(2):211.
11. Kansra P, Oberoi S. Cost of diabetes and its complications: results from a STEPS survey in Punjab, India. Global health research and policy. 2023 Apr 7;8(1):11.