

University of Dongola
Faculty of Medicine

Research Proposal

Prevalence of Diabetes Mellitus among Adult Rural Population at Jertoude Village, Northern State, Sudan, 2026–2027

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1. Research Proposal Title

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3.Introduction

3.1 Background

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood glucose. Hyperglycaemia, also called raised blood glucose or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels.

In 2022, 14% of adults aged 18 years and older were living with diabetes, an increase from 7% in 1990. More than half (59%) of adults aged 30 years and over living with diabetes were not taking medication for their diabetes in 2022. Diabetes treatment coverage was lowest in low- and middle-income countries.

In 2021, diabetes was the direct cause of 1.6 million deaths and 47% of all deaths due to diabetes occurred before the age of 70 years. Another 530 000 kidney disease deaths were caused by diabetes, and high blood glucose causes around 11% of cardiovascular deaths .

Since 2000, mortality rates from diabetes have been increasing. By contrast, the probability of dying from any one of the four main noncommunicable diseases (cardiovascular diseases, cancer, chronic respiratory diseases or diabetes) between the ages of 30 and 70 decreased by 20% globally between 2000 and 2019.[1]

3.2 Problem Statement

Despite the well-documented and rising burden of diabetes mellitus across Sudan and neighbouring River Nile State – where community surveys have reported prevalence figures ranging from roughly 3% to over 19% depending on the population and methodology used [2] . there remains a lack of locally generated, village-level data for rural communities of Northern State such as Jertoude. Diabetes is frequently under-diagnosed in rural, resource-limited settings where routine screening and access to laboratory services are limited, as reflected by the high proportion of newly discovered cases reported in comparable Sudanese studies[3]. Without a clear estimate of local prevalence and its associated risk factors, health authorities and the community itself cannot plan appropriate screening, prevention, or treatment services for Jertoude.

3.3 Justification

Diabetes mellitus (DM) is a growing public health problem, and nearly half of the 589 million adults living with it worldwide are undiagnosed [4]. The African Region has the highest proportion, with about 73% of adults with diabetes unaware of their status [4]. In Sudan, about 3.9 million adults had diabetes in 2024, and roughly 37% of them were undiagnosed [5]. A recent Sudanese study also found a considerable prevalence of undiagnosed type 2 diabetes among primary health care attendees and highlighted the lack of early detection strategies in the country [6]. Community-based data from rural Northern State, including Jertoude Village, are lacking, and facility-based studies are likely to underestimate the true burden.

This study was also motivated by a field observation during a health caravan by medical students from the Faculty of Medicine and Health Sciences, University of Dongola. The participating specialists noted a large number of residents with DM, but this impression is anecdotal and cannot be quantified without a systematic assessment.

A community-based cross-sectional study is therefore warranted. It will estimate the prevalence of DM among adults in Jertoude Village, determine the proportion of undiagnosed cases, and identify associated risk factors. The findings will give health authorities a baseline for screening, resource allocation, and health education. Individuals with undiagnosed diabetes will be referred for confirmation and management, and the study will add to the limited literature on DM in rural Northern Sudan.

3.4 Research Questions

Research Question

What is the prevalence of diabetes mellitus (DM) among the adult rural population (aged ≥18 years) of Jertoude Village, Northern State, Sudan, during 2026-2027, and what factors are associated with it?

Sub-questions

What are the socio-demographic characteristics of adults with DM in Jertoude Village?

What is the proportion of previously undiagnosed DM among the study population?

Which modifiable and non-modifiable risk factors (age, sex, family history, obesity, physical inactivity, hypertension, dietary habits, smoking) are associated with DM in this population.

3.5 Research Hypotheses

Descriptive hypothesis:

The prevalence of DM among adults in Jertoude Village is equal to or higher than the reported national prevalence in Sudan (approximately 10-12%).

Null hypothesis (H_0):

There is no statistically significant association between DM and the studied risk factors (increasing age, family history of DM, obesity, physical inactivity, and hypertension) among adults in Jertoude Village ($p \geq 0.05$).

Alternative hypothesis (H_1):

There is a statistically significant association between DM and the studied risk factors (increasing age, family history of DM, obesity, physical inactivity, and hypertension) among adults in Jertoude Village ($p < 0.05$).

The national prevalence figure above is approximate, so verify it against a current source (e.g., the IDF Diabetes Atlas or a Sudan national STEPS survey) before citing it in your proposal.

3.6 Objectives

General Objective:

To determine the prevalence of diabetes mellitus and its associated risk factors among the adult rural population of Jertoude village, Northern State, Sudan, during 2026–2027.

Specific Objectives:

- To estimate the prevalence of known and newly diagnosed diabetes mellitus among adults (≥18 years) in Jertoude village.
- To estimate the prevalence of impaired fasting glucose in the study population.
- To identify socio-demographic and lifestyle risk factors associated with diabetes mellitus in the study population (age, sex, family history, BMI, physical activity, dietary pattern).
- To assess the level of awareness of diabetes mellitus among the study population.
- To provide recommendations to local health authorities based on the study findings.

4. Literature Review

4.1 NCD Risk Factor Collaboration (NCD-RisC), 2016

NCD Risk Factor Collaboration (NCD-RisC) conducted a large pooled analysis of 751 population-based studies involving approximately 4.4 million adults from 146 countries. The study examined worldwide trends in diabetes prevalence between 1980 and 2014. Age-standardised diabetes prevalence increased from 4.3% to 9.0% among men and from 5.0% to 7.9% among women. The number of adults living with diabetes increased from approximately 108 million in 1980 to 422 million in 2014. The study demonstrated a substantial increase in the global burden of diabetes and highlighted the importance of population-based surveillance and prevention, particularly in low- and middle-income countries.[7]

4.2 Saeedi P, Petersohn I, Salpea P, et al., 2019

Saeedi et al. estimated global and regional diabetes prevalence using 255 high-quality data sources representing 138 countries. The global prevalence of diabetes among adults aged 20–79 years was estimated at 9.3% in 2019, corresponding to approximately 463 million adults. Diabetes prevalence was higher in urban populations (10.8%) than in rural populations (7.2%). Approximately half of adults living with diabetes were estimated to be unaware of their condition. The study

projected that global diabetes prevalence would increase to 10.2% by 2030 and 10.9% by 2045. These findings demonstrate the considerable global burden of diabetes and support the importance of community-based studies, particularly in rural populations.[8]

4.3 Eltom MA, Babiker Mohamed AH, Elrayah-Eliadarous H, Yassin K, Noor SK, Elmadhoun WM, Ahmed MH (2018). Increasing prevalence of type 2 diabetes mellitus and impact of ethnicity in north Sudan. Diabetes Research and Clinical Practice, 136:93–99.

This cross-sectional, population-based study was conducted among adults in Northern State and River Nile State, Sudan, using random multistage cluster sampling. The study targeted 5,376 participants from 14 localities, including both urban and rural clusters, and 5,242 participants completed the study. Blood glucose levels, anthropometric measurements, and demographic information were collected. The prevalence of type 2 diabetes mellitus (T2DM) was 18.7%, while prediabetes was 12.9%. Importantly, 29.0% of participants with T2DM were newly diagnosed cases, indicating a substantial burden of previously undiagnosed diabetes. Significant risk factors included older age, obesity, central obesity, and urban residence. This study is highly relevant to the present research because it provides recent population-based evidence on diabetes prevalence in Northern Sudan, includes rural communities, and demonstrates the presence of undiagnosed diabetes in the region. [2]

4.4 Ahmed AA, Ali OA, Elkarim MSA, et al. (2016). Prevalence of diabetes mellitus and its risk factors in urban communities of north Sudan: Population-based study. Journal of Diabetes, 8:551–558.

This population-based survey enrolled 954 adults from the four main cities of River Nile State, a region bordering Northern State, and measured blood glucose alongside demographic, clinical and anthropometric data. Overall DM prevalence was 19.1%, with 31.3% of cases newly diagnosed during the survey. Increasing age, family history of diabetes, central obesity, abnormal BMI, and hypertension were significant risk factors. Its methodology – a household-based, cross-sectional community survey with anthropometric and glycaemic measurement – closely parallels the approach proposed for Jertoude, and its risk-factor findings inform the variables to be measured in this study.[3]

5. Materials and Methods

5.1 Study Design

A community-based, descriptive, cross-sectional study.

5.2 Study Area

The study will be conducted in Jertoude village, Northern State, Sudan. Northern State is the largest state in Sudan by area (348,765 km²) with an estimated population of 936,255 (2018), .and its capital, Dongola, .The study area is located approximately 25–30 km southeast of Dongola, on the eastern bank of the Nile River. Jertoude is a riverine agricultural village whose population relies mainly on farming and date-palm cultivation along the Nile, a lifestyle pattern shared with other communities in the region where rising diabetes prevalence has already been documented [3].

5.3 Study Population

All adult residents (aged 18 years and above) of Jertoude village who have lived in the village for at least six months, and who consent to participate. Pregnant women and individuals who are acutely ill at the time of the survey will be excluded from glucose testing but may be included in the demographic component where appropriate.

5.4 Inclusion Criteria

The study will include adults aged 18 years and above, of either sex, who are permanent residents of Jertoude Village and have been residing in the area for at least six months. Participants who are willing to participate in the study and provide informed consent will be eligible for inclusion.

5.5 Exclusion Criteria

The study will exclude individuals who are younger than 18 years of age, who are not permanent residents of Jertoude Village or have been residing in the area for less than six months, and who are unwilling to participate in the study or unable to provide informed consent.

5.6 Sample size

The sample size for this study was calculated using the single population proportion formula:

$n_0 = Z^2p(1-p) / d^2$. where Z = 1.96 (corresponding to a 95% confidence level), p = 19.1% (the prevalence rate reported in a comparable community-based survey conducted in River Nile State by Ahmed et al., 2016), and d = 0.05 (5% margin of error). This yielded an initial sample size of approximately 237. Given that the total study population of Jertoude village is finite (N = 2,000), a finite population correction was applied to obtain a more accurate estimate, using the formula:

$n = n_0 / (1 + (n_0 - 1)/N)$. Substituting the values, the corrected sample size was calculated as approximately 213. To account for a potential non-response rate of 10%, the final sample size was increased to approximately 235 participants. A house-to-house systematic random sampling technique will be employed to select participants. All households in Jertoude village will be listed,

and every k-th household will be selected using a systematic sampling interval. Within each selected household, one eligible adult will be chosen using the next-birthday method in cases where more than one eligible member resides in the household. The prevalence estimate of 19.1% was adopted based on its use in a comparable population-based community survey conducted in the neighbouring River Nile State, given the absence of a locally specific prevalence estimate for Jertoude village

5.7 Methods of Data Collection

- A structured, interviewer-administered questionnaire covering socio-demographic data, medical and family history, and lifestyle factors (diet, physical activity, tobacco use).
- Anthropometric measurements: height, weight (for BMI calculation), and waist circumference, using calibrated equipment.
- Blood pressure measurement using a digital sphygmomanometer, with participants seated and rested for 5 minutes.
- Capillary blood glucose testing using a portable glucometer. Fasting blood glucose will be used where feasible in field conditions, with diagnosis of diabetes and impaired fasting glucose based on WHO diagnostic criteria. Participants with elevated glucose results will be referred for confirmatory testing.
- Participants found to have elevated glucose levels will be referred to the nearest health facility for confirmatory testing and management.

5.8 Study Variables

Variable	Type	Measurement
Age	Continuous / independent	Years, from national ID or self-report
Sex	Categorical / independent	Male / Female
Body Mass Index (BMI)	Continuous / independent	Weight (kg) / Height (m)²
Waist circumference	Continuous / independent	cm, measured with tape at midpoint between lowest rib and iliac crest
Blood pressure	Continuous / independent	mmHg, digital sphygmomanometer
Family history of DM	Categorical / independent	Yes / No (1st-degree relative)
Physical activity level	Categorical / independent	Low / Moderate / High (IPAQ short form)
Dietary pattern	Categorical / independent	Structured food-frequency questions
Duration of residence in Jertoude	Continuous / independent	Years
Fasting blood glucose	Continuous / outcome	mg/dL, capillary glucometer, WHO diagnostic criteria
Diabetes status	Categorical / outcome	Known diabetic / newly diagnosed / non-diabetic / impaired fasting glucose

5.9 Data Analysis

Data will be entered and analysed using SPSS (or a comparable statistical package). Descriptive statistics (frequencies, percentages, means, and standard deviations) will summarise socio-demographic and clinical characteristics. The chi-square test will be used to examine associations between categorical variables and diabetes status, and logistic regression will be used to identify independent risk factors. A p-value < 0.05 will be considered statistically significant.

5.10 Ethical Considerations

- Ethical approval will be obtained from the Research Ethics Committee, Faculty of Medicine, University of Dongola, prior to data collection.
- Permission will be sought from the Northern State Ministry of Health and local administrative/community leaders in Jertoude.
- Written or verbal informed consent will be obtained from each participant after explaining the study objectives, procedures, and their right to withdraw at any time without consequence.
- Confidentiality of participant data will be maintained throughout, and results will be reported only in aggregate form.
- Participants identified with abnormal glucose levels will be counselled and referred for appropriate clinical follow-up.

5.11 Timeline (Gantt Chart)

No.	Activity	Period	September 2026	October 2026	November 2026	December 2026	January 2027
1	Research proposal submission	September 2026	✓				
2	Research proposal presentation	September–October 2026	✓	✓			
3	Data collection	October 2026		✓			
4	Data analysis	October–November 2026		✓	✓		
5	Results writing and discussion	November 2026			✓		
6	Final report writing	November–December 2026			✓	✓	
7	Electronic submission of research to the Department of Community Medicine	December 2026				✓	
8	Research evaluation	December 2026				✓	
9	Research revision	December 2026				✓	
10	Research defense	January 2027					✓

Shaded cells (✓) show the month(s) in which each activity is carried out.

5.12 Research Work Plan

The research work plan summarizes the main activities, responsible persons, and expected outputs of the study.

Phase	Main activities	Responsible	Output
1. Preparation	Topic selection, literature review,	All group members; supervisor	Approved research proposal

	proposal writing, and research proposal presentation.		
2. Approvals	Submission for ethical approval and obtaining permission from the Ministry of Health, Locality authorities, and local leaders.	Researchers; supervisor	Ethical approval and local permissions
3. Tool development	Adaptation and preparation of the English interviewer-administered questionnaire based on the WHO STEPS instrument (questions asked verbally in Arabic); preparation of consent form and BP measurement checklist.	Researchers; supervisor	Final study tools
4. Pilot study	Pilot-testing of the questionnaire on about 10% of the planned sample to check clarity, timing, and field procedures.	Researchers	Finalized questionnaire and field procedures
5. Data collection	Household listing and systematic sampling; interviewer-administered questionnaire; blood-pressure measurements and anthropometric measurements.	Researchers / data collectors	Completed questionnaires and measurements
6. Data management	Coding, data entry, cleaning, verification, and preparation of the dataset in SPSS.	Researchers	Clean dataset
7. Analysis	Descriptive statistics, Chi-square tests, and binary logistic regression with 95% CI and $p < 0.05$.	Researchers; statistician/supervisor	Statistical tables and results
8. Reporting	Writing results and discussion, final report preparation, electronic submission, research evaluation, revision, and defense.	All group members; supervisor	Final research report and defense

5.13 Budget Breakdown

Product Name	Price	Quantity	Total
Glucometers	95,000	4	380,000
Strips	65,000	7	455,000
Lancet	9,872	7	69,104
Spirit	11,000	2	22,000
Gloves	35,000	7	245,000
Total			1,171,104 SDG

Transport = 180,000.

Data analysis = 150,000.

Pepper work = 100,000.

Final report printing = 100,000

Total Budget = 1,701,104 SDG

6. References

1. World Health Organization (WHO). Urgent action needed as global diabetes cases increase four-fold over past decades. News release, 13 November 2024. Available at: https://www.who.int/news/item/13-11-2024-urgent-action-needed-as-global-diabetes-cases-increase-four-fold-over-past-decades

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5. International Diabetes Federation. Sudan: Diabetes country report 2000–2050. IDF Diabetes Atlas, 11th ed. 2025. https://diabetesatlas.org/data-by-location/country/sudan/

6. Evaluation of Diabetes Risk Score Tool for Detecting Undiagnosed Type 2 Diabetes Mellitus in Referral Clinics at Primary Health Care Centers in Sudan. Qeios. 2024. https://qeios.com/read/R1RWK2/pdf

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8. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. Diabetes Res Clin Pract. 2019;157:107843. doi:10.1016/j.diabres.2019.107843. (DOI).

7. Annexes

نحن الباحثتان اروا الطاهر وجديه حسن، طالبتان بكلية الطب والعلوم الصحية، جامعة دنقلا، نتقدم إليكم بدعوتكم للمشاركة في بحث علمي بعنوان "معدل انتشار مرض السكري وعوامل الخطورة المرتبطة به بين البالغين المقيمين في قرية جرتودة"، والذي يهدف إلى تحديد مدى انتشار هذا المرض والعوامل المرتبطة بحدوثه بين سكان القرية، بما يسهم في تحسين خدمات الكشف المبكر والوقاية والتخطيط الصحي في المنطقة.

في حال موافقتكم على المشاركة، سيُطلب منكم الإجابة على استبيان يتناول البيانات الديموغرافية والتاريخ المرضي والعائلي ونمط الحياة، إلى جانب إجراء قياسات جسدية بسيطة تشمل الطول والوزن ومحيط الخصر، وقياس ضغط الدم، وفحص مستوى السكر في الدم عبر وخز بسيط في الإصبع باستخدام جهاز قياس السكر المحمول. وستُتاح لكم نتيجة الفحص فور إجرائه، وفي حال تبيّن ارتفاع في مستوى السكر لديكم، سيتم تحويلكم إلى أقرب مرفق صحي لإجراء

الفحوصات التأكيدية والحصول على المتابعة الطبية اللازمة. كما أن مشاركتكم ستسهم في توفير بيانات علمية ذات قيمة تُستخدم لأغراض تخطيط الخدمات الصحية المقدمة لمجتمعكم, تجدر الإشارة إلى أن هذه الدراسة لا تنطوي على أي مخاطر تُذكر، باستثناء إحساس بسيط وعابر بعدم الراحة عند أخذ عينة الدم من الإصبع، وهو أمر مؤقت وطبيعي في هذا النوع من الفحوصات. كما نؤكد أن جميع البيانات التي سيتم جمعها ستُستخدم حصرًا لأغراض البحث العلمي، وستُعامل بسرية تامة، ولن يتم الكشف عن أي بيانات تُعرّف بهويتكم الشخصية في أي تقرير أو منشور علمي ناتج عن هذه الدراسة.

نود التأكيد على أن المشاركة في هذا البحث اختيارية بالكامل، ولكم كامل الحق في الامتناع عن المشاركة أو الانسحاب منها في أي مرحلة من مراحلها، دون أن يترتب على ذلك أي أثر سلبي عليكم أو على حصولكم على أي خدمة صحية تُقدّم لكم.