





BY THE NAME OF ALLAH

University of Dongola

Faculty of Medicine and Health Sciences

Department of Community Medicine

Title Of Research Proposal :

Prevalence and Associated Risk Factors of Coronary Artery Disease Among Diabetic Patients Attending Sheikh Abdulaziz Bin Abdullah Al-Jumaih Center for Diabetes Diseases and Surgery, Dongola City, Northern State, Sudan 2026

Students Names/:

Jehad Hassan hamed hussein

Wejdan Sameer Abdelhadi Hassan

Academic Supervisor Name /:

Nora Eltayeb Abdelkarim

- Introduction

B ackground . :

Type 2 Diabetes Mellitus (T2DM) is a major global public health metabolic crisis of the 21st century, characterized by chronic hyperglycemia resulting from insulin resistance and progressive pancreatic beta-cell dysfunction. According to the International Diabetes Federation (IDF) Diabetes Atlas, an estimated 537 million ,adults were living with diabetes worldwide of whom over 90% have T2DM, a figure .projected to rise to 783 million by 2045 The burden of T2DM is disproportionately)accelerating in low- and middle-income countries LMICs), particularly within the African Region, where health system constraints hinder early detection and optimal .glycemic management

Coronary Artery Disease (CAD) represents the primary cause of morbidity and .mortality among individuals diagnosed with T2DM -Patients with T2DM suffer a two -to four-fold increased risk of developing cardiovascular events compared to non diabetic peers. The cardiovascular pathology in T2DM is complex, accelerated, and ,driven by vascular endothelial dysfunction chronic low-grade inflammation, systemic)oxidative stress, atherogenic dyslipidemia characterized by hypertriglyceridemia, low ,(HDL-C, and small dense LDL particles and hypercoagulability. Furthermore, patients with T2DM frequently present with silent myocardial ischemia due to autonomic neuropathy, delaying therapeutic intervention and leading to poorer clinical .outcomes

In Sudan, the epidemiology of non-communicable diseases (NCDs) is escalating alongside infectious disease pressures. Local epidemiological shifts, rapid urbanization, changing dietary habits, and physical inactivity have contributed to a high prevalence of T2DM and its vascular complications. Despite this rising clinical challenge, localized empirical evidence regarding CAD prevalence and its specific modifiable and non-modifiable risk factors among patients with T2DM in northern .regional tertiary diabetes centers remains sparse

Problem Statement/:

Coronary Artery Disease (CAD) accounts for over 60% of overall deaths among patients with Type 2 Diabetes Mellitus (T2DM). In Sudan, diagnostic delays and constrained cardiac intervention infrastructure often lead to patients with T2DM presenting at advanced stages of ischemic heart disease, heart failure, or fatal acute coronary syndromes (ACS).

The Sheikh Abdulaziz Bin Abdullah Al-Jumaih Center for Diabetes Diseases and Surgery in Dongola City serves as the primary specialized tertiary referral center for T2DM care in Northern State, Sudan. While the center manages a high daily volume of patients with T2DM, baseline epidemiological data regarding the prevalence of CAD and the profile of clinical, metabolic and lifestyle risk factors specific to this cohort are currently lacking. Without accurate local data, healthcare providers cannot formulate targeted preventive strategies or optimize clinical protocols for patients with T2DM.

Justification

Quantifying the burden of CAD and identifying its key driving risk factors (such as poor glycemic control [elevated HbA1c], hypertension, prolonged duration of T2DM, dyslipidemia, obesity, smoking, and microvascular complications) among patients with Type 2 Diabetes Mellitus in Dongola City is critical for several reasons:

Clinical Optimization: Establishing local risk profile markers enables early screening protocols, allowing timely implementation of cardioprotective therapies (e.g., SGLT2 inhibitors, GLP-1 receptor agonists, statins, and antiplatelets) for patients with T2DM.

Health Policy and Resource Allocation: Findings from this research will provide evidence-based insights for the Ministry of Health and hospital administration in Northern State to allocate resources effectively for cardiac diagnostic tools (such as ECG, echocardiography, and cardiac enzyme assays) at diabetes specialty centers.

Academic Contribution: This study addresses a vital data gap in northern Sudanese medical literature regarding T2DM and CAD, serving as a baseline for future longitudinal studies and national cardiovascular health audits.

baseline baseline for future longitudinal studies and national cardiovascular health audits

Research Objectives

Main Objective:

To determine the prevalence and evaluate the associated risk factors of Coronary

*(Artery Disease (CAD) among patients with *Type 2 Diabetes Mellitus (T2DM attending Sheikh Abdulaziz Bin Abdullah Al-Jumaih Center for Diabetes Diseases and .Sudan, during 2026 ,Surgery in Dongola City, Northern State

:Specific Objective

1. To estimate the clinical prevalence of Coronary Artery Disease among patients .with T2DM.

2. To determine the socio-demographic characteristics (age, gender, level of .education, occupation, residence) of patients with T2DM attending the center.

3. To assess the glycemic control status (HbA1c levels) and duration of T2DM .among patients with and without CAD.

4. To identify co-existing traditional cardiovascular risk factors (hypertension, lipid (waist circumference, and tobacco use ,[profile abnormalities, body mass index [BMI .among patients with T2DM.

5. To evaluate the association between CAD and diabetic microvascular and peripheral ,complications (diabetic retinopathy, diabetic nephropathy .neuropathy) in patients with T2DM.

6. To analyze independent predictors of CAD among patients with T2DM using multivariate logistic regression analysis

LITERATURE REVIEW

International Evidence 2.1

Globally, the interrelationship between Type 2 Diabetes Mellitus (T2DM) and coronary artery disease is extensive and robustly documented. Large prospective epidemiological studies, such as the Framingham Heart Study, established that .T2DM doubles the risk of cardiovascular disease in men and quadruples it in women A landmark study by Haffner et al. demonstrated that patients with T2DM without a history of myocardial infarction (MI) had a risk of coronary heart disease events equivalent to non-diabetic patients with a prior history of MI, leading to the International multicenter ".designation of T2DM as a "cardiovascular risk equivalent trials and observational studies consistently report CAD prevalence rates among patients with T2DM ranging between 20% and 45%, depending on the diagnostic criteria utilized (ranging from symptomatic chest pain and resting ECG changes to invasive coronary angiography). A meta-analysis published in the European Heart ,reflected by an HbA1c increase of 1% ,Journal indicated that poor glycemic control correlates with a 15–18% increase in cardiovascular events. Furthermore, comorbid hypertension and atherogenic dyslipidemia synergistically multiply CAD incidence in .populations with T2DM worldwide

(Regional Evidence (Middle East & Africa 2.2

In the Middle East and Sub-Saharan Africa, the burden of cardiovascular disease in T2DM cohorts has reached alarming proportions. A cross-sectional hospital-based study conducted in Saudi Arabia reported a CAD prevalence of 28.4% among patients with T2DM, with age, hypertension, and duration of T2DM >10 years emerging as major independent risk factors. Similarly, studies across North African nations (Egypt, Algeria) demonstrate CAD prevalence rates among T2DM cohorts ranging from 22% to 35%.

2.3 Local Evidence (Sudan)

In Sudan, community and hospital-based research highlights a severe burden of non-communicable diseases. Previous studies conducted in Khartoum state (e.g., at Jabir Abu Eliz Diabetes Center) revealed CAD prevalence rates among patients with T2DM between 18.5% and 26.2%. Research by Ahmed et al. emphasized that hypertension, central obesity, dyslipidemia, and delayed diagnosis were strong determinants of ischemic heart disease among Sudanese patients with T2DM.

However, significant regional variations exist in Sudan regarding healthcare accessibility, socio-economic factors, dietary patterns and lifestyle habits. Northern State, specifically Dongola City, lacks recent published peer-reviewed studies assessing cardiovascular risk factors specifically within its specialized diabetes management centers. This study directly bridges this regional epidemiological gap.

MATERIALS AND METHODS

3.1 Study Design

A facility-based cross-sectional analytical study design will be conducted to establish the prevalence of CAD and assess its associated sociodemographic, clinical, and biochemical risk factors among patients with Type 2 Diabetes Mellitus (T2DM).

3.2 Study Area & Period

Study Area: The study will be conducted at Sheikh Abdulaziz Bin Abdullah Al-Jumaih Center for Diabetes Diseases and Surgery located in Dongola City, the capital of Northern State, Sudan. The center is the principal referral hospital in Northern State, offering specialized diagnostic, curative, surgical, and preventive services for patients with T2DM.

Study Period: The study will be carried out over a 6-month period from June 2026 to November 2026.

3.3 Study Population

Target Population: All adult patients diagnosed with Type 2 Diabetes Mellitus (T2DM) -registered and attending outpatient clinics at Sheikh Abdulaziz Bin Abdullah Al Jumaih Center in Dongola during the study period.

Inclusion Criteria:

- Adult patients (age ≥ 18 years) with a confirmed diagnosis of Type 2 Diabetes Mellitus for at least 6 months.

- Patients who give voluntary written informed consent to participate in the study.

Exclusion Criteria:

- Patients with Type 1 Diabetes Mellitus or gestational diabetes.

- Patients with acute medical crises requiring immediate emergency resuscitation (e.g., hyperosmolar hyperglycemic state, acute pulmonary edema).

- Patients with congenital heart disease, severe valvular heart disease, or non-ischemic cardiomyopathies.

- Pregnant women.

3.4 Sample Size Determination

The required sample size is calculated using Cochran's single proportion formula for cross-sectional studies:

$$n = (Z^2 \times p \times (1-p)) / d^2$$

Where:

n = required sample size

Z = standard normal deviation corresponding to 95% confidence level = 1.96

p = estimated baseline prevalence of CAD among patients with Type 2 Diabetes Mellitus (T2DM) in Sudan (assumed at 22% or 0.22 based on previous regional studies)

d = desired margin of error = 5% (0.05)

Calculation:

$$n = ((1.96)^2 \times 0.22 \times (1 - 0.22)) / (0.05)^2$$

$$= 0.0025 / (0.78 \times 0.22 \times 3.8416) \approx 263.7 \approx 264$$

To account for potential non-response, incomplete questionnaires, or laboratory missing data, a 10% non-response buffer is added (not subtracted):

$$264 + (0.10 \times 264) = 290.4 \approx 290 \text{ patients with T2DM.}$$

3.5 Sampling Technique

A systematic random sampling technique will be applied. Based on average daily attendance records at the center (~50 patients with T2DM daily), every k-th patient presenting to the outpatient clinic during the data collection period will be invited to participate after obtaining informed consent.

Operational Definitions 3.6

1. Poor Glycemic Control: HbA1c ≥ 7.0% (Good control: < 7.0%) per ADA criteria.

2. Obesity: BMI ≥ 30 kg/m² (Overweight: 25-29.9 kg/m², Normal: 18.5-24.9 kg/m² per WHO classification.

3. Hypertension: Systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg, or currently on antihypertensive medication.

Data Collection Tools & Measurement 3.7

Data will be gathered by trained medical personnel using a standardized, pre-tested, structured interview-administered questionnaire and clinical assessment sheet comprising four main domains:

1. Socio-demographic Profile:Age, sex, occupation, level of education, residence, and smoking status.

2. Clinical & Anthropometric Data:

- Blood pressure: measured using a standardized mercury sphygmomanometer after 5 mins rest in sitting position. Hypertension defined as SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg or current use of antihypertensive drugs.

- Body Mass Index (BMI = weight in kg / height in m²): Obesity defined as BMI ≥ 30 kg/m².

- Waist circumference, duration of T2DM, and current antidiabetic treatment regimens.

3. CAD Diagnostic Criteria:CAD will be operationalized as present if the patient with T2DM fulfills at least one of the following criteria:

- Documented medical history of acute coronary syndrome (STEMI, NSTEMI, or unstable angina), coronary revascularization (PCI or CABG).

- Positive Rose Angina Questionnaire for ischemic chest pain.

- Electrocardiographic (12-lead ECG) evidence of myocardial ischemia/infarction (ST-segment elevation/depression, pathological Q waves, or inverted T waves, confirmed by a cardiologist).

4. Laboratory Investigations:Glycated hemoglobin (HbA1c) [Poor control defined as HbA1c ≥ 7.0%], fasting blood glucose (FBG), serum lipid profile (Total Cholesterol, Triglycerides, HDL-C, LDL-C), and serum creatinine / urinary albumin-to-creatinine ratio (ACR).

Data Management and Statistical Analysis 3.8

Data will be cleaned, coded, and entered into IBM SPSS Statistics version 26.0 for analysis. Continuous variables will be presented as means ± standard deviations SD) or medians (interquartile ranges), while categorical variables will be presented) .as frequencies and percentages

The Chi-square test (χ^2) or Fisher's exact test will be used for categorical -comparisons between T2DM patients with CAD and those without CAD. Student's t test or Mann-Whitney U test will evaluate continuous variables between the two $p < 0.10$) in bivariate analysis will be)groups. Variables demonstrating significance entered into a multivariate binary logistic regression model to identify independent T2DM*, calculating Adjusted Odds Ratios *risk factors for CAD among patients with Statistical significance will be defined as p .(AOR) with 95% Confidence Intervals (CI) .0.05 >

Ethical Considerations 3.9

- Ethical clearance will be formally obtained from the Health Research Ethics Committee of the Faculty of Medicine, University of Dongola, and the Northern State .Ministry of Health

- Administrative approval will be secured from the administration of Sheikh Abdulaziz .Bin Abdullah Al-Jumaih Center

- Written informed consent will be obtained from all adult patients with T2DM prior to .enrollment; participation is strictly voluntary

- Patient confidentiality, anonymity, and data protection will be strictly maintained .throughout all stages of research using coded identification numbers

WORK PLAN & TIMELINE

The proposed research activity is scheduled across a 24-week period in 2026 as :outlined in the Gantt chart below

Submission of research proposals	Septembe ,r 20–24 2026
Presentation of research proposals	Septembe –r 27 ,October 1 2026
Collection	October 4 2026 ,22–

Data analysis	October – 25 November 2026 ,5
Writing and discussing the results	November ,19–8 2026
Writing the final report	November –22 December 2026 ,3
Electronic submission of research projects to the Community Medicine Department	December ,10–6 2026
Evaluation of the research projects	December ,24–13 2026
Corrections to the research projects	December ,31–27 2026
Research defense/presentation	January 3 2027 ,4–

BUDGET OUTLINE .5

The estimated financial budget required for data collection materials, laboratory diagnostic reagents, printing, ECG

:(paper, and administrative items is detailed below (in SDG / USD equivalents

No	Item Description	Unit Cost (SDG)	Quantity	Total Cost (SDG)
1	Ethical Review	10000	1	10000

	& Administrative Fees			
2	Printing Questionnaires Consent & Forms	200	310copies	62000
3	Laboratory Testing Kits Lipid ,HbA1c) (Profile	200	290tests	58000
4	Lead ECG -12 Machine &Consumables Paper	100	290tests	29000
5	Data Collector 2)Incentives (Investigators	15000_	3months _	30000_
6	Statistical &Analysis Software Licensing	5000	1lump	5000
7	Final Report &Printing Binding	1200	5copies	6000
	TOTAL ESTIMATED BUDGET			200000

6. REFERENCES (VANCOUVER FORMAT)

1. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. Brussels: International Diabetes Federation; 2021.

2. Haffner SM, Lehto S, Rönnemaa T, Pyörälä K, Laakso M. Mortality from coronary heart disease in subjects with type 2 diabetes and in nondiabetic subjects with and without prior myocardial infarction. N Engl J Med. 1998;339(4):229-234.

3. American Diabetes Association. 10. Cardiovascular Disease and Risk Management: Standards of Care in Diabetes—2024. Diabetes Care. 2024;47(Suppl 1):S179-S218.

4. Cosentino F, Grant PJ, Aboyans V, Bailey CJ, Ceriello A, Delgado V, et al. 2019 ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD. Eur Heart J. 2020;41(2):255-323.

5. Al-Rubeaan K, Al-Hamed FA, Subhani SN, Youssef AM, Al-Qumaidi HF. Prevalence of coronary artery disease and its risk factors among type 2 diabetic patients in Saudi Arabia. BMC Cardiovasc Disord. 2020;20(1):142.

6. Ahmed MH, Awadalla H, Elmadhoun WM, Noor SK, Almobarak AO. Prevalence of cardiovascular risk factors among Sudanese individuals with type 2 diabetes: A hospital-based study. J Diabetes Complications. 2017;31(6):982-987.

7. Elbagir MN, Eltom MA, Elmahadi EM, Asplund K. Pattern of diabetes mellitus in Sudan: a hospital-based study. J Intern Med. 1998;243(4):273-278.

8. Cochran WG. Sampling Techniques. 3rd ed. New York: John Wiley & Sons; 1977.

9. Rose GA. The diagnosis of ischaemic heart pain and intermittent claudication in field surveys. Bull World Health Organ. 1962;27(6):645-658.

10. World Health Organization. Prevention of Cardiovascular Disease: Guidelines for Assessment and Management of Cardiovascular Risk. Geneva: World Health Organization; 2007.