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# Determinants of Chronic Kidney Disease among Adult Diabetic Patients at Dessie Comprehensive Specialized Hospital, Ethiopia, 2024: An institution-based case control study

**Ali Mohammed*, Gebiyaw Wudie and Abebaw Gedef**

*Department of Epidemiology and Biostatistics, School of Public Health, Bahir Dar University, Bahir Dar, Ethiopia.*

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***Correspondence:** Ali Mohammed, Department of Epidemiology and Biostatistics, School of Public Health, Bahir Dar University, Bahir Dar, Ethiopia.*

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## ABSTRACT

***Background:*** *Chronic kidney disease is a condition where high blood glucose or blood pressure damages the blood vessels in the kidneys and reduces their function. It develops slowly; so many people do not realize they have it until it has reached an advanced stage. Chronic kidney disease can be prevented by controlling blood glucose and blood pressure, avoiding harmful medications, and changing lifestyle. Though prior studies were conducted on chronic kidney disease among adult diabetics in the Amhara region, possible determinant such as glycated hemoglobin level was not assessed.*

***Objective:*** *To identify the determinants of Chronic Kidney Disease Among Adult Diabetic Patients at Dessie Comprehensive Specialized Hospital, Amhara Region, Ethiopia, 2024.*

***Methods:*** *We conducted an institutional-based unmatched case-control study between January 1 and June 30, 2024. Cases were adult diabetic patients with chronic kidney disease, and controls were adult diabetic patients without chronic kidney disease. All cases were included, while systematic random sampling was used to select controls. Data from interviews, laboratory and clinical records were collected and entered into Epi Info version 7.2, then exported to Statistical Package for Social Science version 27 for analysis. Multivariable binary logistic regression was used to identify determinants of chronic kidney disease, and a p-value less than 0.05 was considered statistically significant.*

***Results:*** *A total of 95 cases and 190 controls were recruited in the study. The median (interquartile range) age of cases and controls were 62 (67-45) and 37.5 (61-26.75) years, respectively. The study revealed that poor glycemic control (HbA1c) (AOR: 3.33, 95% CI: 1.63-6.81), age ≥60 years (AOR: 2.70, 95% CI: 1.36-5.37), presence of albuminuria (AOR: 4.83, 95% CI: 2.19-10.73), analgesics use (AOR: 2.43, 95% CI: 1.26-4.70), and duration of diabetes greater than or equal to 10 years (AOR: 2.52, 95% CI: 1.30-4.88) had statistically significant associations with chronic kidney disease among adult diabetic patients.*

***Conclusion:*** *The study finding indicated that poor glycemic control, older age, positive albuminuria, use of analgesics, and long duration of diabetes were significantly associated with chronic kidney disease among adult diabetic patients. We recommend an individualized glycemic target for older patients and patients with a long duration of diabetes.*

***Keywords:*** *Chronic Kidney Disease; Diabetes; glycated hemoglobin; Adult; Dessie; Ethiopia.*

## Background

Chronic kidney disease (CKD) is a condition characterized by the gradual loss of kidney function over at least three months [1]. Specific criteria, such as a urine albumin/creatinine ratio (UACR) at or above 30 mg/g and a decreased glomerular filtration rate (eGFR) below 60 mL/1.73 m², are used to make the diagnosis [2].

Diabetes mellitus is the most frequent cause of chronic kidney disease [1-4]. It occurs when uncontrolled blood glucose damages the blood vessels in the kidneys and due to the buildup of waste products that suppress insulin production, thereby reducing kidney function [4]. Both type 1 diabetes, an autoimmune form of diabetes, and type 2 diabetes, which is largely linked to lifestyle factors such as smoking, alcohol use, and obesity, can cause CKD [5].

The prevention of chronic kidney disease in diabetic patients includes controlled blood glucose and blood pressure levels, lifestyle changes, including making healthier choices about what you eat and drink, physical activity, and treatment with medications. These approaches and treatments may keep CKD from worsening and prevent additional health problems in diabetic patients [6].

Chronic kidney disease is extremely common and has emerged as one of the leading non-communicable causes of death worldwide. It is projected to affect an increasing number of individuals over time and to further rise in importance among the various global causes of death [7]. According to a study, there were 135 million patients, 2.6 million incident cases, and 0.5 million deaths from chronic kidney disease in diabetics worldwide in 2019 [8]. The global burden of chronic kidney disease among diabetic patients was 26.2% [9]. In a systematic review and meta-analysis study done in Africa, the pooled prevalence of chronic kidney disease among patients with diabetes was estimated between 24.7%-32.6% [10,11]. Ethiopia is one of the developing countries with a high burden of chronic kidney disease due to swift changes in lifestyle. According to a systematic review and meta-analysis study done in Ethiopia, the pooled prevalence of chronic kidney disease among diabetic patients was 18.22% [12]. Whereas the burden of chronic kidney disease among adult diabetic patients in the Amhara region varies from 14.3% to 26.3% [13-15].

Chronic kidney disease among diabetic patients may have major effects on their personal, family, and national health, as well as economic and psychosocial aspects [16].

Several prevalence studies have been conducted on chronic kidney disease among diabetic patients in the Amhara region, specifically in Bahir Dar, Dessie, and Gondar [13-15]. However, these studies have shown inconsistencies in the variables used. For instance, in the study conducted in Dessie, variables such as habitual alcohol use, smoking cigarettes, Khat chewing, use of traditional medicine, and analgesics were not included [14]. However, variables like Khat chewing, lipid profile, and hemoglobin A1c (HbA1c) were not assessed in Bahir Dar, Dessie, and Gondar [13-15].

One important factor that needs to be addressed in this study is the glycated hemoglobin A1c (HbA1c) level and its association with CKD in adult DM patients. Those studies used fasting blood glucose tests to measure the status of glycemic control, which provides a snapshot of blood glucose levels at a moment and is influenced by recent food intake, stress, illness, and medication adherence. While HbA1c reflects long-term glycemic control and treatment effectiveness, it is less affected by short-term fluctuations and provides an overall measure of average blood glucose levels over time [17-19].

HbA1c is a widely used biomarker for long-term glucose control in individuals with diabetes. It provides crucial information about average blood glucose levels over a prolonged period, thus serving as a valuable tool for diagnosing and managing diabetes [20-22]. While there is a considerable body of literature exploring the clinical utility of HbA1c, there remains a noticeable gap in research concerning CKD among adult DM patients in our study area.

This study aims to bridge this gap by investigating CKD among adult DM patients in relation to HbA1c levels. By examining this under-explored area, we can gain valuable insights into the management of adult diabetic patients. The findings of this study will not only contribute to the existing body of knowledge about HbA1c but also provide clinicians and researchers with a deeper understanding of the management of CKD among adult DM patients, enabling them to make more informed decisions regarding patient care and future research directions.

To overcome those limitations, our study focused on measuring blood glucose levels using HbA1c as a variable, along with other important factors, and employed a case-control study design. By including variables such as habitual alcohol use, smoking cigarettes, Khat chewing, use of traditional medicine, analgesics, and lipid profile, we aimed to provide a more comprehensive understanding of the potential risk factors contributing to CKD in diabetic patients. The aim of our study was to identify the determinants of chronic kidney disease among adult diabetic patients who receive follow-up care at Dessie Comprehensive Specialized Hospital.

## Methods and Materials

### Study Setting

The study was carried out at the Dessie Comprehensive Specialized Hospital in Dessie city. Dessie Comprehensive Specialized Hospital provides comprehensive medical services for nearly 10 million people in the eastern part of Amhara and the neighboring Afar and Tigray regions. The hospital provided nearly 420,000 outpatient and more than 35,000 inpatient services annually. It also provides follow-up care for more than 1,200 diabetic patients monthly. It delivers diagnostic, therapeutic, monitoring, and tertiary care services for all diabetic and CKD patients. Patients with diabetes and chronic kidney disease can receive curative and preventive care at the hospital [23]. The hospital used a dipstick test for albumin for follow-up care [24].

**Study Design and Period**
An institution-based unmatched case-control study design was conducted from January 1, 2024, to June 30, 2024.

**Source Population**
**Cases:** All adults aged 18 years or older who were diagnosed as diabetic patients with CKD at Dessie Comprehensive Specialized Hospital.

**Controls:** All adults aged 18 years or older who were diagnosed as diabetic patients without CKD at Dessie Comprehensive Specialized Hospital.

**Study Population**
**Cases:** All adults aged 18 years or older who were diagnosed as diabetic patients with CKD and had at least 3 months of follow-up at Dessie Comprehensive Specialized Hospital during the data collection period.

**Controls:** All adults aged 18 years or older who were diagnosed as diabetic patients without CKD and had at least 3 months of follow-up at Dessie Comprehensive Specialized Hospital during the data collection period.

**Eligible Criteria**
**Inclusion**
**Case:** All adults aged 18 years or older who presented to Dessie Comprehensive Specialized Hospital during the data collection period, who had diabetes mellitus with chronic kidney disease that had been diagnosed at least three months prior to the data collection period.

**Control:** All adults aged 18 years or older who presented to Dessie Comprehensive Specialized Hospital during the data collection period and had diabetes mellitus that had been diagnosed at least three months prior to the data collection period without chronic kidney disease.

**Exclusion**
Excluded from the study were those who had incomplete information regarding their diagnosis and follow-up history for CKD and DM and were either critically ill or suffering from a psychiatric disorder at the time of the data collection period.

**Study Variables**
**Dependent Variable**
Chronic kidney disease among adult diabetic patients (Yes/No)

**Independent Variables**
**Socio-demographic factors:** Age, sex, residence, level of education, occupational type, and marital status.

**Comorbidity-related factors:** Presence of hypertension, pre-existing hypertension, and cardiovascular disease.

**Clinically related factors:** Types of medications, duration of diabetes, types of diabetes, body mass index, and use of analgesics.

**Behavioral factors:** Smoking, alcohol drinking, chewing chat, physical exercise, and use of traditional medicines.

**Biochemical characteristics:** Hemoglobin A1c, level of albuminuria, total cholesterol level, high-density lipoprotein, and low-density lipoprotein.

**Operational Definitions**
**CKD:** Has a decreased glomerular filtration rate (eGFR) below 60 mL/1.73 $m^2$, present for ≥3 months with or without evidence of kidney damage (1,2,9-13).

**Diabetes:** Is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both (4,25).

**Good glycemic control:** A study participant with an HbA1c value below 8.0%.

**Poor glycemic control:** A study participant with an HbA1c value of 8.0% and above.

**High total cholesterol:** A study participant with >200 mg/dL.

**High LDL:** A study participant with ≥120 mg/dL.

**Low HDL:** A study participant with <40 mg/dL.
High triglyceride level: A study participant with >160 mg/dL.

**Albuminuria:** Urine dipstick results were used to determine the urine albumin level, which was reported as negative, or +1 to +4 or positive.

**Smoking:** Smoking status was assessed by asking, "How many of the past 7 days did you smoke a cigarette or cigar, even just one puff?" Respondents who reported 0 days were considered non-smokers. All others were categorized as smokers [25].

**Alcohol consumption:** Determined by using the CAGE international screening tool to assess a patient's alcohol use/abuse. Each response to the four CAGE questions is scored with points: either 0 points for "no" or 1 point for "yes". A total score of less than 2 was considered non-alcoholic, and 2 and above was considered alcoholic [26].

**Khat chewing**
Assessed by screening tools that have five questions and a 15-score. If a person scores a total of five or below, they are considered a non-Khat chewer, and ≥6 will be considered a Khat chewer [25].

**Sample size determination**
The sample size was determined using Epi Info version 7.2 by analyzing published research of predictor variables, then systolic blood pressure was used as a predictor variable from Bahir Dar, Ethiopia [15]. The calculated sample size was 263; then, by adding a 10% non-respondent rate, 10% × 263 = 26.3, the final sample size was 291. Therefore, 97 cases and 194 controls were chosen from the source population to conduct an unmatched hospital-based case-control study.

**Sampling technique and procedures**
During the follow-up period, all 97 cases were enrolled, and controls were selected by using a systematic random sampling technique.

The total number of controls (N) = 1200, and then the interval (Kth) was calculated: Kth = N/n = 1200/194 = 7.

The first unit, which was 3, was selected randomly using lottery techniques from 1 to 7 patients. Subsequently, to reach a sample size of 194 controls, the selected individuals would be the 3rd, 10th, 17th, and so on, until we reached the 194th individual.

**Data collection methods**

Data were collected by using a structured face-to-face interviewing questionnaire and patient's chart review.

To ensure accuracy and consistency, the questionnaire was initially prepared in English and then translated into the local Amharic language by a proficient bilingual speaker. Subsequently, a different individual translated the questionnaire back into English to validate the accuracy of the translation. To conduct the data collection process, three certified nurses, one lab technologist, and one supervisor were involved. The supervisor ensured that the data collectors submitted their collected data daily. The supervisor then reviewed the data for consistency and completeness to ensure its quality.

**Measurement Tools**

**Anthropometric measurements**

The height of study participants was measured in a standing position without footwear or headgear by using a stadiometer. Their head, shoulders, buttocks, and heels were aligned with the vertical surface of the audiometer. The weight was measured using a portable weighing scale in kilograms. Participants stood without any footwear that could affect their body weight. Afterward, the body mass index (BMI) was calculated by dividing the weight (in kilograms) by the square of the height (in meters). The BMI values were then used to classify participants into different categories: underweight (BMI <18.5), normal weight (BMI 18.5-24.9), overweight (BMI 25-29.9), and obese (BMI ≥30) [3, 27].

**Vital Sign Measurement**

Blood pressure was measured by using an analog sphygmomanometer and stethoscope. The measurements were taken from the upper arm of the patient, with the arm positioned at heart level after the patient had been seated for at least 5 minutes.

**Biochemical Measurement**

The laboratory technologist collected three milliliters of blood from each study participant into a heparinized EDTA tube and separated the serum. Then, an Automated Chemistry Machine was utilized to perform the HbA1c assay, total cholesterol, triglyceride, high-density lipoprotein, and low-density lipoprotein at Dessie Comprehensive Specialized Hospital [24].

A laboratory technologist collected ten milliliters of freshly voided urine from study participants to do a urine dipstick test to assess the urine albumin level. The results of the test were reported as negative (absence of albumin) or graded on a scale from +1 to +4, indicating increasing levels of albumin presence in the urine [24].

**Data processing and analysis**

The data were entered using Epi Info version 7.2, and then exported to SPSS version 27 for analysis. Frequencies and cross-tabulations were used to summarize descriptive statistics. The results were presented using figures, tables, and words. The enter method was used for multivariable binary logistic regression. In the case of multivariable binary logistic regression, a variable was considered a candidate if its p-value in the simple binary logistic analysis was less than or equal to 0.25.

Variables that had a P-value of ≤ 0.05 at a 95% confidence interval in the multiple binary logistic regressions were considered statistically significant. To evaluate the associations between CKD among adult diabetic patients and independent variables, the 95% confidence interval and P-value were employed. The adjusted odds ratio was used to assess the strength of association between CKD and the predictor variables.

The final multiple binary logistic regression model was fitted using the Hosmer and Lemeshow test, with a p-value of 0.85, Omnibus test p-value < 0.001, and Nagelkerke R Square value of 0.494, which means the proportion of the total variation in the outcome that can be explained by the independent variables in the model.

**Data quality control**

Data quality was assured by training the data collectors and supervisors. To ensure the accuracy of laboratory tests, the clinical chemistry laboratory at DCSH strictly followed standard operating procedures (SOPs). Before the actual data collection period, a pretest of the questionnaire was conducted on 15 patients (5% of the total sample size) at Boru-Meda Hospital. Before the analysis, the frequency and cross-tabulation of each variable with the outcome variable were performed.

**Ethical Consideration**

The study was approved by the Bahir Dar University Ethical Review Board Committee (868/2023). To ensure proper authorization, a letter of authorization was obtained from the Amhara Public Health Institution. Written informed consent was obtained from each participant in the study after providing them with a comprehensive understanding of the study's objectives. It was made clear that participation was voluntary and that individuals had the right to decline participation at any time. The privacy of the participants was ensured by using codes to keep their information confidential. Participants were also informed that if any abnormal results were identified, they would be notified and appropriately referred to a physician for further care.

## Results

**Socio-demographic Characteristics of the Study Participants**

From a sample of 291 (97 cases and 194 controls), 285 (95 cases and 190 controls) participated in the study, giving a response rate of 97.9%.

The median ages of cases and controls were 62 and 37.5, with interquartile ranges of (67-45) and (61-26.75) years, respectively.

Fifty-nine (62.1%) cases and 101 (53.2%) controls were male.

Regarding the residential areas, 56 (58.9%) of cases and 133 (70.0%) controls lived in urban areas. In terms of marital status, 68 (71.6%) of cases and 100 (52.6%) of controls were married. According to education level, 26 (27.4%) of cases and 67 (35.5%) of controls had completed college and above. Thirty-three (31.6%) of cases and 60 (31.6%) of controls were self-employed (Table 1).

**Table 1:** Sociodemographic characteristics of diabetic patients attending Dessie Comprehensive Specialized Hospital, Northeast Ethiopia, 2024.

| Variables | Category | Disease Status | |
|---|---|---|---|
| | | Cases (n=95), n (%) | Controls (n=190), n(%) |
| Age | Greater than or equal to 60 years | 62 (65.3) | 52 (27.4) |
| | Less than 60 years | 33 (34.7) | 138 (72.6) |
| Gender | Male | 59 (62.1) | 101 (53.2) |
| | Female | 36 (37.9) | 89 (46.8) |
| Residence | Rural | 39 (41.1) | 57 (30.0) |
| | Urban | 56 (58.9) | 133 (70.0) |
| Education | Unable to read and write | 22 (23.2) | 38 (20.0) |
| | Read and write | 6 (6.3) | 37 (19.5) |
| | Primary | 17 (17.9) | 23 (12.1) |
| | Secondary | 24 (25.3) | 25 (13.2) |
| | College and above | 26 (27.4) | 67 (35.3) |
| Marital status | Single | 10 (10.5) | 60 (31.6) |
| | Married | 68 (71.6) | 100 (52.6) |
| | Divorced | 11 (11.6) | 20 (10.5) |
| | Widowed | 6 (6.3) | 10 (5.3) |
| Occupation | Government employee | 13 (13.7) | 20 (10.5) |
| | Non-government employee | 8 (8.4) | 16 (8.4) |
| | Self-employed* | 33 (34.7) | 60 (31.6) |
| | Student | 11 (11.6) | 45 (23.7) |
| | Housewife | 9 (9.5) | 13 (6.8) |
| | Retired | 11 (11.6) | 18 (9.5) |

** Such as merchants, contractors, etc.*

**Clinical and comorbidity characteristics of the study participants**

Among the study participants, 73 (76.8%) of cases and 95 (50.0%) of controls had type two diabetes mellitus. Sixty (63.2%) of cases and 50 (26.3%) of controls had a duration of 10 years or more after the diagnosis of diabetes mellitus. Regarding medically confirmed comorbidity, 34 (35.8%) of cases and 38 (20.0%) of controls had pre-existing hypertension (Table 2).

**Table 2:** Clinical characteristics of diabetic patients attending Dessie Comprehensive Specialized Hospital, Northeast Ethiopia, 2024.

| Variables | Category | Cases (n=95), n (%) | Controls (n=190), n (%) |
|---|---|---|---|
| Type of DM | Type One | 22 (23.2) | 35 (36.8) |
| | Type Two | 73 (76.8) | 95 (50.0) |
| Duration of Diabetes | Less than 10 years | 35 (36.8) | 140 (73.7) |
| | Greater than or equal to 10 years | 60 (63.2) | 50 (26.3) |
| Pre-existing Hypertension | Present | 34 (35.8) | 38 (20.0) |
| | Absent | 61 (64.2) | 152 (80.0) |
| Pre-existing CVD | Present | 21 (22.1) | 24 (12.6) |
| | Absent | 74 (77.9) | 166 (87.4) |
| Use of Analgesics | Used | 56 (58.9) | 50 (26.3) |
| | Not used | 39 (41.1) | 140 (73.7) |
| Have Hypertension | <140/90 mmHg | 50 (52.6) | 136 (71.6) |
| | ≥140/90 mmHg | 45 (47.4) | 54 (28.4) |
| Medication use | Oral hypoglycemic agent | 71 (74.7) | 97 (51.1) |
| | Insulin | 24 (25.3) | 93 (48.9) |

Among the study participants, 17 (17.9%) of cases and 25 (13.2%) of controls were overweight (Table 3).

**Table 3:** Proportion of body mass index categories among diabetic patients attending Dessie Comprehensive Specialized Hospital, Northeast Ethiopia, 2024.

| Body Mass Index | Category | Cases (n=95), n (%) | Controls (n=190), n (%) |
|---|---|---|---|
| Body Mass Index | Underweight | 5 (5.3) | 12 (6.3) |
| | Normal | 50 (52.6) | 123 (64.7) |
| | Overweight | 17 (17.9) | 25 (13.2) |
| | Obese | 23 (24.2) | 30 (15.8) |

**Behavioral characteristics of the study participants**

Among the study participants, 15 (15.8%) of cases and 64 (33.7%) of controls did physical exercise.

According to the study, 38 (40.0%) of cases and 53 (27.9%) of controls had a past history of smoking cigarettes. From the study, 9 (9.5%) of cases and 9 (4.7%) of controls had alcohol consumption, and 10 (10.5%) of cases and 11 (5.8%) of controls had a Khat chewing habit, respectively (Table 4).

**Table 4:** Behavioral characteristics of diabetic patients attending Dessie Comprehensive Specialized Hospital, Northeast Ethiopia, 2024.

| Variables | Category | Cases (n=95), n (%) | Controls (n=190), n (%) |
|---|---|---|---|
| Physical exercise | Yes | 15 (15.8) | 64 (33.7) |
| | No | 80 (84.2) | 126 (66.3) |
| Current smoking status | Smoker | 12 (12.6) | 9 (4.7) |
| | Non-smoker | 83 (87.4) | 181 (95.3) |
| Past history of smoking status | Yes | 38 (40.0) | 53 (27.9) |
| | No | 57 (60.0) | 137 (72.1) |
| Alcohol consumption habit | Alcoholic | 9 (9.5) | 9 (4.7) |
| | Non-alcoholic | 86 (90.5) | 181 (95.3) |
| Khat chewing | Khat chewer | 10 (10.5) | 11 (5.8) |
| | Non-Khat chewer | 85 (89.5) | 179 (94.2) |
| Previously used traditional medicines | Yes | 15 (15.8) | 33 (17.4) |
| | No | 80 (84.2) | 157 (82.6) |
| Current use of traditional medicines | Yes | 7 (7.4) | 6 (3.2) |
| | No | 88 (92.6) | 184 (96.8) |

**Biochemical characteristics of the study participants**

According to the findings of this study, 75 (78.9%) had an HbA1c level of 8% and above, while 20 (21.1%) had a level of less than 8%. Among controls, 67 (35.3%) and 123 (64.7%) of study participants had HbA1c levels of 8% and above and less than 8%, respectively. More cases (75 [78.9%]) than controls (67 [35.3%]) had an HbA1c level of 8% and above.

Fifty-four cases (56.8%) tested positive for albuminuria, while a smaller proportion (43.2%) tested negative. In contrast, a significantly lower percentage of controls (13.2%) tested positive for albuminuria.

Among the study participants, 22 (23.2%) of cases had more than 200 mg/dL total serum cholesterol, while the majority (76.8%) had below 200 mg/dL. Among controls, a similar pattern was observed, with 21.6% having more than 200 mg/dL total serum cholesterol and the majority (78.4%) having below 200 mg/dL. A significant percentage of cases (63.2%) had less than 40 mg/dL of HDL levels, while a smaller portion (36.8%) had more than 40 mg/dL, indicating a more favorable lipid profile. In the control group, a higher percentage (73.7%) had more than 40 mg/dL of HDL levels. The majority of cases (56.8%) had above 120 mg/dL of LDL levels, while a smaller portion (43.2%) had below 120 mg/dL. Among controls, a higher percentage (75.3%) had less than or equal to 120 mg/dL of LDL levels. A significant proportion of cases (52.6%) had greater than 160 mg/dL of triglyceride levels, while a slightly smaller portion (47.4%) were below 160 mg/dL. In the control group, a lower percentage (28.9%) had greater than 160 mg/dL of triglyceride levels.

**Factors associated with CKD among adult diabetic patients**

All variables were assessed using simple binary logistic regression, and variables which had a p-value ≤ 0.25 were eligible for multiple binary logistic regression analysis. Variables such as age, gender, duration of diabetes, pre-existing hypertension and cardiovascular disease, use of analgesics, past smoking cigarette, body mass index, presence of hypertension, presence of albuminuria, level of HbA1c, HDL, and triglyceride had a p-value ≤ 0.25 and were included for further analysis.

In the multiple binary logistic regression analysis, poor glycemic control (HbA1c), older age, positive albuminuria, analgesic drug use, and longer diabetes duration had a statistically significant association with CKD in adult diabetic patients at 95% CI (Table 5).

**Table 5:** Factors associated with chronic kidney disease among adult diabetic patients attending Dessie Comprehensive Specialized Hospital, Northeast Ethiopia, 2024.

| Variables | Category | CKD status | | COR (95% CI) | AOR (95% CI) |
|---|---|---|---|---|---|
| | | Cases (n=95) | Controls (n=190) | | |
| Age | ≥60 years | 62 | 52 | 4.99 (2.94-8.46) | 2.70 (1.36-5.37)* |
| | <60 years | 33 | 138 | 1 | 1 |
| Gender | Male | 59 | 101 | 1.44 (0.87-2.39) | 1.10 (0.55-2.23) |
| | Female | 36 | 89 | 1 | 1 |
| Pre-existing hypertension | Present | 34 | 38 | 2.23 (1.29-3.86) | 1.32 (0.59-2.95) |
| | Absent | 61 | 152 | 1 | 1 |
| Pre-existing CVD | Present | 21 | 24 | 1.96 (1.03-3.75) | 1.77 (0.75-4.21) |
| | Absent | 74 | 166 | 1 | 1 |
| Use of analgesics | Used | 56 | 50 | 4.02 (2.39-6.77) | 2.43 (1.26-4.70)* |
| | Not used | 39 | 140 | 1 | 1 |
| History of smoking | Yes | 38 | 53 | 1.72 (1.03-2.90) | 0.92 (0.44-1.91) |
| | No | 57 | 137 | 1 | 1 |
| HbA1c | Poor | 75 | 67 | 6.88 (3.87-12.25) | 3.33 (1.63-6.81)* |
| | Good | 20 | 123 | 1 | 1 |
| Albuminuria | Positive | 54 | 25 | 8.69 (4.84-15.60) | 4.85 (2.19-10.73)* |
| | Negative | 41 | 165 | 1 | 1 |
| HDL | Low | 60 | 50 | 4.80 (2.83-8.13) | 1.17 (0.52-2.64) |
| | Normal | 35 | 140 | 1 | 1 |
| Triglyceride | High | 50 | 55 | 2.73 (1.64-4.54) | 1.31 (0.61-2.80) |
| | Normal | 45 | 135 | 1 | 1 |
| Have hypertension | Yes | 45 | 136 | 1 | 0.71 (0.32-1.55) |
| | No | 50 | 54 | 0.44 (0.26-0.74) | 1 |
| Duration of diabetes | <10 years | 35 | 140 | 1 | 1 |
| | ≥10 years | 60 | 50 | 0.21 (0.12-0.35) | 2.52 (1.30-4.88)* |
| BMI | Obese | 23 | 30 | 1.70 (0.93-3.14) | 1.22 (0.50-2.96) |
| | Non-obese | 72 | 160 | 1 | 1 |

*COR = Crude Odds Ratio; AOR = Adjusted Odds Ratio; CI = Confidence Interval; *=P-value ≤ 0.05.*

## Discussion

This study was conducted to identify the determinant factors of chronic kidney disease among adult diabetic patients at Dessie Comprehensive Specialized Hospital, Amhara Region, Ethiopia, 2024. The finding of the study suggests that poor glycemic control, older age, positive albuminuria, analgesic drug use, and longer diabetes duration are associated with an increased probability of developing chronic kidney disease (CKD) in adult diabetic patients.

The study found that the odds of CKD were 3.33 times higher among adult diabetic patients with poor glycemic control compared to those with good glycemic control (AOR: 3.33, 95% CI: 1.63-6.81). This finding was in line with a study done at Tigray and Jimma hospitals [28-30]. This suggests that poorly controlled blood sugar levels in diabetic patients can significantly increase the risk of chronic kidney disease. When blood sugar levels remain high over time, it can lead to damage to the blood vessels in the kidneys and nephrons. This damage impairs the proper functioning of the kidneys and can contribute to the development and progression of chronic kidney disease [6].

Besides, our study revealed that the odds of CKD were 2.70 times higher among adult diabetic patients aged ≥60 years as compared to their counterparts (AOR: 2.70, 95% CI: 1.36-5.37). This finding is congruent with other studies done in the United Kingdom, Australia, Palestine, Botswana, Ghana, Uganda, Harar, Gondar, and Bahr Dar [13,15,31-38]. This implies that the mechanisms underlying this association are due to age-related physiological changes in glomerular filtration rate [2,39].

Moreover, the odds of CKD were 4.83 times higher among adult diabetic patients with positive albuminuria as compared to those patients with negative albuminuria (AOR: 4.85, 95% CI: 2.19-10.73). The result was consistent with studies done at Harar, Jimma, and Bahir Dar [15, 31, 40]. When waste products become built up and damage the small blood vessels in the kidneys, this damage impairs the kidneys' ability to filter waste products properly, leading to the leakage of albumin into the urine [5,41-44].

As well, the odds of CKD were 2.43 times higher among adult diabetic patients who used analgesic drugs as compared to their counterparts (AOR: 2.43, 95% CI: 1.26-4.70). Our study provided that there is a statistically significant association between the use of analgesic drugs and the probability of developing chronic kidney disease in adult diabetic patients. This might be due to the long-term and high-dose usage of the drugs, which causes interstitial nephritis, which can impair their ability to filter waste products and fail to maintain proper kidney function, then end with CKD [39].

Furthermore, the odds of CKD were 2.52 times higher among adult diabetic patients who had a duration of diabetes greater than or equal to 10 years as compared to those patients who had less than 10 years of duration (AOR: 2.52, 95% CI: 1.30-4.88). Studies conducted in Botswana, Uganda, Ghana, and Ethiopia provide evidence that supports the association between the duration of DM and the development of chronic kidney disease among adult diabetic patients [31,32,34,36,45). This may be due to the prolonged exposure to high levels of glucose among patients, which damages the tiny blood vessels of the kidney, reduces blood flow, and causes CKD [4,39].

In our study, we found that factors such as body mass index, type of diabetes, pre-existing hypertension, high-density lipoprotein (HDL), triglyceride levels, and alcohol consumption did not show a statistically significant association with the development of chronic kidney disease among adult diabetic patients [14,28,40, 46-49]. However, it's important to note that these results may vary due to differences in study design, sample size, and the population being studied.

## Strengths and Limitations of the Study

The study utilizes multiple data sources, such as interviews, medical records, and laboratory tests, to validate exposure and outcome information. This approach reduces the reliance on self-reporting and enhances the accuracy of the data collected.

Since we conducted a hospital-based case-control study and, as such, inpatient cases were not included. Therefore, further studies with similar designs are needed to validate and expand upon these findings in order to obtain a more comprehensive understanding of the factors influencing the outcome in the broader population of adult diabetic patients.

## Conclusion

The study findings indicate that chronic kidney disease (CKD) among adult diabetic patients is significantly associated with poor glycemic control, older age, and a longer duration of diabetes. Additionally, the presence of albuminuria and the regular use of analgesics were identified as key risk factors.

## Recommendations

We recommend individualized glycemic targets for older patients and patients with a long duration of diabetes. Establish routine, strict screening for albuminuria and kidney function in patients with long-standing diabetes or advanced age.

Implement intensive glucose-monitoring strategies and tailor medication regimens for patients struggling to meet HbA1c targets.

Avoid or use the lowest effective dose of nonsteroidal anti-inflammatory drugs for the shortest duration possible.

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## Author Contributions

» **Ali Mohammed Wolle:** Contributed to designing the study, writing the original draft, formal data analysis, data interpretation, manuscript preparation, and finalization.

» **Gebiyaw Wudie:** Supervision, review, editing, and data interpretation.

» **Abebaw Gedef:** Supervision, review, editing, and data interpretation.

» All authors read and approved the final manuscript.


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