



Prevalence of Chronic Kidney Disease and Associated Factors among Patients with Diabetes in Northwest Ethiopia: A Hospital-Based Cross-Sectional Study

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ABSTRACT

Background: Chronic kidney disease (CKD) is increasingly recognized as a global health issue and it affects 10% to 15% of the world population. Diabetes mellitus is the leading cause of end-stage renal disease. More than 422 million adults in the world populations are living with diabetes mellitus, 40% of whom will develop CKD. CKD in diabetes increases the risk of early death and cardiovascular morbidity and mortality. There is a paucity of published data on the prevalence of CKD and its associated factors among patients with diabetes in northwest Ethiopia.

Objective: The aim of this study is to determine the prevalence and factors associated with CKD among patients with diabetes at University of Gondar Hospital, Northwest Ethiopia.

Methods: A hospital-based cross-sectional study was conducted from April 2 to July 31, 2018. Using convenience sampling, a total of 272 consecutive patients with diabetes were recruited for the study. Data regarding the patients' sociodemographic information, clinical characteristics, and laboratory parameters were collected using patient interview and review of medical records. Serum creatinine was measured and used to calculate estimated glomerular filtration rate using modification of diet in renal disease and chronic kidney disease epidemiology equations. Data were analyzed using SPSS version 20. Bivariate and multivariate logistic regression analyses were used to identify predictors of CKD in patients with diabetes. **Result:** The prevalence of CKD, defined by estimated glomerular filtration rate <60 mL/min/1.73 m², was found to be 17.3% and 14.3% by modification of diet in renal disease and chronic kidney disease epidemiology equations, respectively. The proportion of stage 3 CKD by modification of diet in renal disease equation was 14.7%, whereas the proportions of stage 4 and stage 5 CKD were 2.2% and 0.4%, respectively. Among those who were diagnosed with CKD, 85.1% had pre-existing hypertension. Multivariate logistic regression analysis revealed that the presence of retinopathy (adjusted odds ratio = 14; 95% CI, 4–36; $p < 0.001$), pre-existing hypertension (adjusted odds ratio = 8.2; 95% CI, 2–23; $P < 0.001$), current systolic blood pressure >140 mm Hg (adjusted odds ratio = 6; 95% CI, 4–22; $P = 0.001$), and duration of diabetes >10 years (adjusted odds ratio = 3.2; 95% CI, 2–7; $P = 0.004$) were significantly associated with CKD in patients with diabetes.

Conclusions: The prevalence of CKD in patients with diabetes is high and comparable with previous studies from low- and middle-income countries. Pre-existing hypertension, current systolic blood pressure >140 mm Hg, duration of diabetes >10 years, and presence of retinopathy were significantly associated with CKD. Regular screening for CKD, retinopathy, and optimal blood pressure management should be practiced.

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Introduction

Chronic kidney disease (CKD) is an increasing major global health problem.¹ Globally, the estimated overall prevalence of CKD is 8% to 16%, and this corresponds to nearly 500 million individuals, of whom 78% (387.5 million) reside in low- to middle-income

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countries.² CKD is associated with increased risks of mortality and cardiovascular events.³

It is estimated that the incidence rates of CKD in low- to middle-income countries might be up to 4 times higher than those observed in developed countries. In sub-Saharan Africa, CKD more commonly affects individuals aged between 20 and 50 years, and the age of onset of end-stage renal disease (ESRD) is 20 years earlier in populations of African descent compared with other ethnic groups in Western countries (45 years vs 63 years).^{2,4}

The magnitude of CKD in most parts of Africa is unknown mainly due to a shortage of national registries and lack of community-based studies. Some studies from East Africa and Egypt suggest that CKD is 3 or 4 times more frequent in the developing world. The prevalence of diabetic nephropathy is estimated to be 6% to 16% in sub-Saharan Africa.⁵ A systematic review showed the prevalence of CKD in Africa ranging from 2% to 41%.^{4,6}

Globally, common causes of CKD are diabetes and hypertension. Diabetes causes 30% to 50% of all cases of CKD and ESRD worldwide. Screening for CKD based on estimated glomerular filtration rate (eGFR) is recommended in patients with diabetes for early identification and treatment.⁷

Tropical nephropathy (ie, glomerulonephritis) is still the main cause of CKD in sub-Saharan Africa. Kidney disease associated with HIV infection was responsible for a majority of ESRD burden in Africa.⁸

The World Health Organization estimates that, globally, 422 million adults older than age 18 years (8.5% of the world adult population) were living with diabetes in 2014. According to this estimate, 25 million adults in Africa (7.1%) live with diabetes.⁹ More than 40% of people with diabetes will develop CKD and a significant number will develop ESRD, requiring renal replacement therapies.¹⁰ It estimated that by the year 2030, more than 70% of patients with ESRD will be residents of developing countries.¹¹ Patients with both diabetes and CKD are at higher risk of cardiovascular morbidities and mortality, kidney failure, and death when compared with those without CKD.^{12,13}

Ethiopia is facing a double burden from communicable and noncommunicable diseases. Noncommunicable diseases and injuries account for 52% of the total mortality in 2016 in Ethiopia.¹⁴ Although diabetes is becoming prevalent in Ethiopia, data on the prevalence of CKD and determinant factors in patients with diabetes are scarce. Previous hospital-based studies in Ethiopia showed a CKD prevalence of 18.2% and 23.8% and using modification of diet in renal diseases (MDRD) and Cockcroft-Gault (CG) equations, respectively, in patients with diabetes in Butajira Hospital.¹⁵

A similar hospital-based study performed in 2016 at Gondar University Hospital showed the overall prevalence of CKD as 21.8%. In this study, only 3.9% of participants have CKD defined by eGFR <60 mL/min/1.73 m² using the MDRD equation, and the majority (20.1%) have CKD defined by albuminuria using the urine dipstick test.¹⁶

Despite evidence showing the incidence of CKD in patients with diabetes is high in other regions, there are limited data on the national prevalence and associated factors of CKD in Ethiopia. Previous Ethiopian studies reported CKD prevalence using eGFR estimated with MDRD and CG equations, whereas the chronic kidney disease epidemiology (CKD-EPI) equation is the most widely used and accepted equation. Moreover, in the study performed at Gondar University Hospital, the prevalence of CKD defined by eGFR is very low compared with other regions, and this study excluded patients with cardiovascular disease (CVD). Therefore, this study aimed to assess the prevalence and factors associated with CKD among patients with diabetes, including those with CVD comorbidity, using both MDRD and CKD-EPI equations.

Materials and Methods

Study settings and design

A hospital-based cross-sectional study was conducted from April 2 to July 31, 2018, at the University of Gondar hospital. The hospital is located in northwest Ethiopia in the historic town of Gondar, which is 750 km away from the capital, Addis Ababa. The hospital has a bed capacity of 600 beds and serves as a tertiary referral hospital for a population catchment area of nearly 7 million. A diabetes clinic that was established in 1985 provides services to 3029 registered patients with diabetes mellitus. Around 120 patients with diabetes are seen in the clinic every Tuesday and Friday. Routine evaluations include fasting blood sugar measurements during each visit; annual retinal examination; and screening for CVD, including echocardiography when needed. Simple routine urinalysis is performed for most patients but quantitative proteinuria measurement is not routinely practiced due to unavailability of tests. The hemoglobin A1c test is not readily available in the clinic.

Study participants

The source population included patients with diabetes who had hospital records of diagnosis of diabetes mellitus with follow-up at the University of Gondar Hospital.

Inclusion criteria were older than age 18 years, patients with type 2 diabetes, and patients with type 1 diabetes 5 years after their initial diagnosis. Participants with acute illness requiring hospital admission, having recent or persistent diarrhea or vomiting, acute bleeding, having hypertensive urgency or emergency, and pregnant women were excluded.

Sample size and sampling procedure

The sample size was calculated at a prevalence of 22% with a 95% CI and the degree of precision of 5%. Using convenience sampling 272 study participants were recruited consecutively. A total of 300 patients were approached with response rate of 90.6%.

Data collection

Data were collected through an investigator administered pretested questionnaire. The questionnaire was pretested in 27 patients with diabetes for accuracy. Patients were interviewed to obtain demographic data and risk factor variables. Patient records were reviewed to obtain information on relevant medical history like duration of diabetes mellitus, presence of hypertension diagnosis in the past, retinopathy, medication history, and laboratory parameters such as fasting blood sugar level. The presence of comorbidities, such as stroke or cardiac disease, was reviewed from patient medical records. Physical examinations, including measurement of height, weight, and blood pressure, were performed. Body mass index (BMI) was calculated using weight and height computed as weight in kilograms divided by height in meters.² Obesity was defined as BMI >30. Blood pressure was measured by general practitioners using sphygmomanometer and stethoscope. Measurements were taken from the upper arm while placing the hand at heart level after the patients had been sitting for more than 5 minutes. Hypertension was defined as systolic blood pressure (SBP) >130 mm Hg or diastolic blood pressure >80 mm Hg or current use of antihypertension medication.

Laboratory measurements

Venous blood (2 mL) was taken from each patient to determine the serum creatinine level and calculate eGFR. Serum creatinine

level was measured in a single laboratory using automated clinical chemistry analyzer (Pentra C400; Horiba France, Longjumeau Cedex, France). Internal quality was assured by running control test every day before analyzing patients' sera. GFR was estimated using the MDRD equation $GFR = 186 \times [\text{serum creatinine (mg/dL)}]^{-1.154} \times (\text{age})^{-0.203} \times (0.742 \text{ for women}) \times (1.210 \text{ for African Americans})$, and CKD-EPI equation, $GFR (\text{mL/min/1.73 m}^2) = 141 \times \min(\text{Scr}/\kappa, 1)^\alpha \times \max(\text{Scr}/\kappa, 1)^{-1.209} \times 0.993 \text{ age}$

Where α is -0.329 for women and -0.411 for men, min indicates the minimum of serum creatinine (Scr) / κ , and κ is 0.7 for women and 0.9 for men, α is -0.248 for women and -0.207 for men. Urine protein (ie, albumin) quantitative measurements were not available in the setup and hence only functional estimation using serum creatinine level was used.

CKD is defined as $eGFR < 60 \text{ mL/min/1.73 m}^2$. The stages of eGFR were categorized based on the classification system established by the National Kidney Foundation Kidney Disease Outcomes Quality Initiative classification where stage 3 = eGFR of 30 to 59 mL/min/1.73 m², stage 4 = eGFR of 15 to 29 mL/min/1.73 m², and stage 5 = eGFR of <15 mL/min/1.73 m². Stage 3 was further classified into 3a (eGFR of 45–59.9 mL/min/1.73 m²) and 3b (eGFR of 30–44.9 mL/min/1.73 m²).

The last 3 consecutive fasting blood sugar measurements were obtained from the patient file to calculate average fasting blood sugar. Laboratory results were communicated by telephone to those participants with $eGFR < 60 \text{ mL/min/1.73 m}^2$, and these participants were advised to have further follow-up and contact with the renal care clinic.

Statistical analysis

Data were entered into EPI info version 3.2 (Centers for Disease Control and Prevention, Atlanta, Georgia) and analyzed using SPSS version 20 (IBM-SPSS Inc, Armonk, NY). Normally distributed variables are summarized by their means (SD); median and range are used for skewed data. Independent 2-sample test analysis was used to compare the means of 2 variables. Cross-tabulation with χ^2 analysis was used for between-group comparisons of CKD proportions. Descriptive statistics, including the proportion, mean, median, and frequencies are depicted with tables and graphs. The association of independent variables with the dependent variables was tested using stepwise binary logistic regression. Adjusted odds ratio (AOR) with 95% CI was used to describe associations with $P < 0.05$ taken as statistically significant.

Ethical consideration

Ethical approval for this research was obtained from the University of Gondar, College of Health Science Institutional Research Ethics Committee. Participants were informed about the procedures, the objectives, and the benefits of the research. Serum creatinine was measured for free but there was no other incentive given to participants. Informed written consent was obtained from each participant.

Results

Sociodemographic characteristics of participants

A total of 272 participants were included in the study. The mean (SD) age of participants was 51.67 (13.75) years with the minimum and maximum age being 20 years and 81 years, respectively. The majority of the study participants were between ages 46 and 60 years (44.1% [n = 120]) and 23% (n = 64) were older than age 60 years. The proportion of men and women was similar. Most

Table 1
Sociodemographic characteristics of participants (N = 272).

Characteristic	n	%
Age category, y		
18-30	26	9.6
31-45	62	22.8
46-60	120	44.1
61-90	64	23.5
Sex		
Male	137	50.4
Female	135	49.6
Residence		
Urban	190	69.9
Rural	82	30.1
Marital status		
Married	215	79
Single/widowed/divorced	57	21
Education level		
No formal school	98	36
Elementary school and less	77	28.3
High school and more	97	35.7
Monthly income, ETB		
<1500	153	56.3
>1500	119	43.8
Occupation		
Not government employed	191	70.2
Government employed	81	29.8

ETB=Ethiopian birr; at the time of writing, \$1 = 32ETB.

study participants resided in an urban area (69.9% [n = 191]) and 174 (64%) had received formal education (Table 1).

Clinical characteristics of participants

The proportion of patients with type 2 and type 1 diabetes mellitus was 171 (62.9%) and 101 (37.1%), respectively. There was equal sex distribution among patients with both type 1 and type 2 diabetes.

The mean and median BMI of study participants was 23.79 and 23.2, respectively. Seventy-one (26.1%) and 25 (9.2%) patients were overweight and obese, respectively, most of whom were participants with type 2 diabetes. Most type 2 study patients were found in the age range of 45 to 60 years and 23% were older than age 60 years. The mean (SD) duration of diabetes was 9.05 (6.43) years with the minimum and maximum duration being 3 months and 49 years, respectively.

Among all study participants, 46% had pre-existing hypertension and most of them were taking 1 or 2 antihypertension medications. The proportion of hypertensive patients was higher in type 2 patients than in type 1 patients (84.8% vs 15.2%). Regardless of therapy, 56% of all study participants had current SBP in the range above 140/90 mm Hg. We found that 37.1% of patients with diabetes have an average fasting blood sugar level >170 mg/dL, which is an indicator of poor glycemic control (Table 2). A small proportion of participants had a history of smoking and alcohol consumption. There was a statistically significant difference in the mean values of age, BMI, blood pressure, and duration of diabetes between type 1 and type 2 participants (Table 3).

Prevalence of CKD

The prevalence of CKD (defined by $eGFR < 60 \text{ mL/min/1.73 m}^2$) was found to be 17.3% (95% CI, 12.8%–21.8%) and 14.3% (95% CI, 9.8%–18.3%) using MDRD and CKD-EPI equations, respectively. The prevalence of all the stages of CKD is shown in Table 4.

Table 2
Clinical characteristics of participants (N = 272).

Characteristic	n	%
Type of diabetes		
1	101	37.1
2	171	62.9
Duration of diabetes, y		
≥10	113	41.5
<10	159	58.5
Drug for diabetes		
Insulin only	134	49.3
Oral agent only	107	39.3
Insulin + oral agent	31	11.4
Body mass index category		
Underweight	25	9.2
Normal weight	151	55.5
Overweight	71	26.1
Obese	25	9.2
Pre-existing hypertension		
Present	125	46
Absent	147	59.6
Stage of current systolic blood pressure, mm Hg		
Normal (<120)	72	26.5
Elevated (120–129)	48	17.6
Stage 1 (130–139)	100	36.8
Stage 2 (≥140)	52	19.1
Stage* of current diastolic blood pressure, mm Hg		
60–79	113	41.5
80–89	109	40.1
90–109	50	18.4
Presence of retinopathy		
Present	31	11.4
Absent/not known	241	88.6
Cardiovascular disease		
Present	40	14.7
Absent	232	85.23
Type of cardiovascular disease		
Congestive heart failure/ hypertensive heart disease	12	4.4
Ischemic heart disease	17	6.3
Peripheral artery disease	2	0.7
Stroke	3	1.1
Other†	6	2.2
None	232	85.3
Previous known kidney disease		
Present	7	2.6
Absent	265	97.4
Family history of kidney disease		
Present	3	1.1
Absent/unknown	269	98.9
Noncardiovascular illness		
Present	20	7.4
Absent	268	98.5

* Diastolic blood pressure stages are defined as normal (60–79 mm Hg), stage 1 (80–89 mm Hg), or stage 2 (90–109 mm Hg).

† Other types of cardiovascular disease include degenerative valvular heart disease and dyslipidemia.

There was no statistically significant difference in the proportions of CKD between the 2 types of diabetes: 13.9% in type 1 versus 19.2% in type 2 by MDRD and 10.9% in type 1 versus 16.4% in type 2 by CKD-EPI equation.

Factors associated with CKD according to MDRD and CKD-EPI equations

On bivariate analysis, factors significantly associated with CKD include the following variables: age >60 years, presence of pre-existing hypertension, current SBP >140 mm Hg, duration of diabetes >10 years, presence of retinopathy, presence of pre-existing cardiovascular disease, current or past smoking, habitual use of analgesics, and no regular exercise. On multivariate analysis, only 4 variables were found to have statistically significant association with the presence of CKD by both MDRD and CKD-EPI equations:

Table 3
Behavioral characteristics of participants (N = 272).

Characteristic	n	%
Smoking status	11	4
Smoker (current or past)		
Nonsmoker	261	96
Exercise sessions, wk		
None	170	62.5
2 or more	102	37.5
Dietary habit of fruits and vegetables		
None/occasional	188	69.1
Regular consumer	84	30.9
Alcohol consumption, drinks/d		
None or <2	213	78.3
More than 2	59	21.7
Habitual analgesia use		
Yes	17	6.3
No	255	93.8
Traditional medicine use		
Yes	7	2.6
No	265	97.4

the presence of retinopathy, pre-existing hypertension, current SBP, and duration of diabetes >10 years (Table 5).

Patients with retinopathy were 14 (AOR = 14; 95% CI, 4–36; $P < 0.001$) times and 18 (AOR = 18; 95% CI, 6–40; $P < 0.001$) times more likely to develop CKD than having no retinopathy using MDRD and CKD-EPI equations, respectively. The odds of CKD was 6 (AOR = 6; 95% CI, 4–22; $P < 0.001$) times higher among patients with diabetes having current SBP >140 mm Hg compared with patients having SBP <140 mm Hg. Patients with pre-existing hypertension and duration of diabetes >10 years were 8.2 (AOR = 8.2; 95% CI, 2–23; $P < 0.001$) and 3.2 (AOR = 3.2; 95% CI, 1.6–7; $P = 0.004$) times more likely to develop CKD than their counterparts, respectively (Table 6).

Discussion

To the best of our knowledge, this study among the few studies in Ethiopia to assess the prevalence of CKD in patients with diabetes using estimating equations based on serum creatinine level. It is the first study to evaluate CKD prevalence using both MDRD and CKD-EPI equations. A total of 272 patients with diabetes were included in the study and the overall prevalence of CKD (defined by eGFR <60 mL/min/1.73 m²) was 17.3% and 14.3% by MDRD and CKD-EPI equations, respectively. The majority of patients (9.6%), had stage 3a CKD and only 0.4% had stage 5 CKD.

The 2016 US National Health and Nutrition Examination Survey (NHANES) (2007–2012) cross-sectional analysis of adults with diabetes found the overall prevalence of stage 3 and above CKD using CKD-EPI equation was 18.9%. The prevalence of CKD using CKD-EPI in this study is lower than NHANES survey data and this could be due to the difference between the population characteristics, including age (51.6 years in this study vs 61.5 years in the NHANES cohort), mean duration of diabetes (9 years in this study vs 13.5 years in the NHANES cohort), different racial groups, and different settings where the studies were conducted.¹⁷

The prevalence of CKD in patients with diabetes in eastern Mediterranean countries, using MDRD, was 19.5%, which is similar to our study.¹⁸ A similar prevalence was reported in Spain: 18% using eGFR by MDRD equation. However, the overall prevalence of CKD was reported to be 27% in the Spanish study when both eGFR and albuminuria were used to define CKD.¹⁹ Higher CKD prevalence was reported from studies in Pakistan (29.9%) and India (48.8%) using eGFR and albuminuria.^{19,20} Our study did not use other markers of CKD like albuminuria, and this might underesti-

Table 4

Mean values of age, body mass index (BMI), blood pressure (BP), and duration of diabetes mellitus (DM) type 1 or type 2.

Variable	Type 1 DM*	Type 2 DM*	Mean difference (95% CI)	P value
Age, y	41.0 (13)	57.0 (9.8)	-16.7 (-19.4 to 13.9)	< 0.001
Systolic BP	121.0 (15.6)	134.8(17)	-13.48 (-17.5 to -9.2)	< 0.001
Diastolic BP	75.6 (8)	79.0 (8)	-3.8 (-5.9 to 1.7)	< 0.001
BMI	21.0 (2.7)	25.0 (3.8)	-4.0 (-4.9 to 3.2)	< 0.001
Duration of diabetes, y	11.0 (6.5)	7.0 (6)	3.4 (1.8 to 5.0)	< 0.001

* Values are presented as mean (SD).

Table 5

Proportion of different stages of chronic kidney disease (CKD) according to modified diet in renal disease (MDRD) and chronic kidney disease-epidemiology (CKD-EPI) equations (N = 272).

Stage of CKD	Description	eGFR, mL/min/1.73 m ²	MDRD*	CKD-EPI*
Stage 3a	Mild to moderately decreased	45–59.9	26 (9.6)	18 (6.6)
Stage 3b	Moderate to severely decreased	30–44.9	14 (5.1)	14 (5.1)
Stage 4	Severely decreased	15–29.9	6 (2.2)	7 (2.6)
Stage 5	ESRD	≤15	1 (0.4)	1 (0.4)
Total			47 (17.3)	40 (14.7)

eGFR = estimated glomerular filtration rate; ESRD = end-stage renal disease.

* Values are presented as n (%).

Table 6

Factors associated with chronic kidney disease (CKD) according to modified diet in renal diseases (MDRD) and chronic kidney disease-epidemiology (CKD-EPI) equations (N = 272).

Factor	CKD by MDRD			CKD-EPI		
	AOR	95% CI	P value	AOR	95% CI	P value
Age, y						
>60	1.3	0.5–2.9	0.08	1.2	0.4–2	0.09
<60						
Pre-existing HTN						
Yes	8.2	2–23	< 0.001	8.3	2–24	< 0.001
No						
Type of DM						
1	0.8	0.2–1.2	0.3	0.9	0.3–1.5	0.4
2						
Duration of DM, y						
≥10	3.2	1.6–7	0.004	3.2	1.5–7	0.004
<10						
Retinopathy						
Present	14	4–36	< 0.001	18	6–40	< 0.001
Absent						
CVD						
Present	2	0.9–5	0.1	2.1	0.8–5	0.1
Absent						
Current SBP, mm Hg						
>140	6	4–22	< 0.001	7.2	5–28	< 0.001
<140						
Habitual analgesic use						
Yes	2.2	0.8–7	0.2	2	0.7–7	0.25
No						

CVD = cardiovascular disease; DM = diabetes mellitus; HTN = hypertension; SBP = systolic blood pressure.

mate the prevalence of CKD in diabetic populations in the study setting.

A systematic review from community-based studies on the prevalence of CKD in Africa ranged between 2% to 41% and varied across the region. The estimated prevalence in East Africa ranged from 7% to 15%.⁴

A 2014 hospital-based study in southern Ethiopia to determine the prevalence of CKD in patients with diabetes found a prevalence of 18.2% and 23.8% by MDRD and CG equations, respectively.¹⁵ Using the MDRD equation, the prevalence of CKD in our study and southern Ethiopia is similar.

A similar hospital-based study performed in 2016 at Gondar University Hospital (similar setting as the current study) showed an overall prevalence of CKD at 21.8%. In this study, only 3.9% of

participants had CKD defined by eGFR <60 mL/min/1.73m² using the MDRD equation and the majority (20.1%) had CKD defined by albuminuria using the urine dipstick test.¹⁶ The prevalence of CKD in this report using the MDRD equation is lower than the finding in our study (3.9% vs 17.3%). This could be due to the exclusion of patients with diabetes and CVD in the previous study. Diabetes has systemic micro- and macrovascular complications and patients with CVD are likely to have concomitant renal complications. We used patient records to determine the presence of CVD, and this could even underestimate the presence of important comorbidity.

Although not statistically significant, elderly patients have a higher proportion of CKD (ie, 26.6%) (corrected OR = 2.7; P = 0.001) by MDRD and 25% by CKD-EPI. This is consistent with other stud-

ies that showed advanced age as a consistent risk factor for the development of CKD in patients with diabetes.^{21–23}

In our study, pre-existing hypertension as well as current SBP >140 mm Hg are strongly and independently associated with the presence of CKD. Among 125 patients with hypertension and diabetes, 32.1% had CKD. Several prior studies in both developed and developing countries support this finding.^{17,24,25} Among patients who developed CKD and were taking antihypertension medications, most patients' current blood pressure readings were not in the target range. Physicians should emphasize optimization of hypertension treatment to lower blood pressure so that the emergence and progression of CKD can be delayed. Duration of diabetes >10 years is independently associated with the development of CKD (29.3% vs 8.8%) and our study findings were consistent with others in this regard.^{2,17,26}

Among 31 patients who were diagnosed with retinopathy, 74.2% developed CKD. Retinopathy is independently associated with the presence of CKD. This finding is also consistent with previous large-scale studies.²⁷ This warrants screening for ophthalmic complications in patients with diabetic kidney disease and vice versa.

In our study, there was no statistically significant association between CKD and level of blood fasting blood sugar. Because this was a cross-sectional study, it is difficult to assess long-term glycemic control and its effect on CKD. Another limitation of our study is that we used the last fasting blood sugar levels and this might not represent the true glycemic control. Hemoglobin A1c would have been a better option to assess glycemic control. This cross-sectional study cannot assess the progression of renal impairment. We used only eGFR to assess renal status, so the prevalence of CKD in the study population may be underestimated. Neither estimating equation is validated in the Ethiopian population.

Limitations of the study

This hospital-based study might not reflect the true prevalence of CKD in patients with diabetes in the community. We used eGFR <60 mL/min/1.73 m² to define CKD and the prevalence of CKD in the study group could be underestimated because we did not use albuminuria or other structural abnormalities that define CKD. This lack of albuminuria testing does not permit us to be more definitive about the diagnosis of diabetes-related kidney disease, but it is our assumption that it is diabetes-related kidney disease.

Conclusions

The prevalence of CKD in the population we studied (defined as eGFR <60 mL/min/1.73 m²) was 17.3% and 14.3% using MDRD and CKD-EPI equations, respectively. By using the MDRD equation, the prevalence of CKD in this study was similar to most previously published studies. The presence of retinopathy, pre-existing hypertension, and longer duration of diabetes is associated with the presence of CKD. Routine CKD screening should be implemented in patients with diabetes for early detection and delayed progression of CKD. We also recommend screening all patients with diabetes for retinopathy and hypertension, and optimizing blood pressure goals to prevent CKD. Further large survey studies using additional markers like albuminuria and imaging are needed to know the exact burden of CKD in patients with diabetes.

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Drs Hailu, Alemu and Adane were all involved in the conception and design of the study. Drs Hailu and Alemu analyzed the data and prepared the draft manuscript. All authors critically revised the content of the manuscript and read and approved the final version.

Conflicts of Interest

The authors have indicated that they have no conflicts of interest regarding the content of this article.

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