

## Research Article

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## Prevalence and Associated Factors of Chronic Kidney Disease among Diabetic and Hypertensive Patients at Ambo Town Public Hospitals of West Shewa Zone, Oromia Region, Ethiopia

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### ABSTRACT

**Background:** Chronic kidney disease is a global public health important disease that is associated with life threatening outcomes including renal failure and premature mortality unless diagnosed and treated promptly. Diabetes Mellitus and hypertension are the two major causes of chronic kidney disease worldwide. This study is aimed to determine prevalence and associated factors of chronic kidney disease among diabetes mellitus and hypertensive patients at Ambo town public hospitals, Ethiopia.

**Methods:** A cross-sectional study was conducted at Ambo University referral and general hospitals on 308 study participants. The participants were interviewed using interviewer administered questionnaire when they come for follow up at a chronic illness follow-up clinic. The patient charts were reviewed to retrieve information regarding medications, blood pressure, serum Creatinine and glucose level. A chronic kidney disease epidemiology collaboration equation was used to estimate Glomerular filtration rate from serum Creatinine. Data were analyzed SPSS version 23 for statistical analysis. Binary logistic regression analysis was used to identify factors associated with chronic kidney disease. Variables with a p-value below 0.2 at bivariable analysis were entered into the multivariable logistic regression model. Multivariable logistic regression analysis was used to examine the association between dependent and independent variables and p-value less than 0.05 was used to declare statistical significance.

**Results:** A total of 308 diabetic and hypertensive patients were included in the study. Of which 156 (50.6%) participants were female with mean ( $\pm$  SD) age of  $47.15 \pm 12.06$  years. The prevalence of chronic kidney disease (stage 3-5) was 20.5% with (95% CI: 16%-25%). Long duration of hypertension (AOR=4.89, 95% CI=1.93-12.40), elevated systolic blood pressure ( $>140$ mmHG) (AOR=3.20, 95% CI=1.36-7.51), family history (AOR=3.36, 95% CI=1.56-7.24) and age greater than 55 years (AOR=2.17, 95% CI=1.09-4.31) were factors associated with chronic kidney disease.

**Conclusion:** The prevalence of chronic kidney disease was high. Older age, elevated SBP, long duration of hypertension and family history of kidney disease were factors associated with chronic kidney disease. A preventive plan is mandatory to reduce the disease and complications in the community.

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### Abbreviation

ACEI=Angiotensin-Converting Enzyme Inhibitor, ARB=Angiotensin Receptor Blocker, BP=Blood Pressure, BMI=Body Mass Index, CKD=Chronic Kidney Disease, DM=Diabetes Mellitus, DBP=Diastolic Blood Pressure, EFETP=Ethiopian Field Epidemiology Training Program, ESRD=End-Stage Renal Disease, FBS=Fast Blood Sugar, GFR=Glomerular Filtration Rate, KEEP=Kidney Early Evaluation Program, MDRD=Modification of Diet in Renal Disease, SBP=Systolic Blood Pressure, SPHMMC=Saint Paul's Hospital Millennium Medical College.

### Background

Chronic kidney disease (CKD) is a worldwide public health problem, with undesired outcomes of renal failure and premature death if not diagnosed and treated promptly. CKD is defined as kidney damage or glomerular filtration rate (GFR)  $<60$  ml/min/1.73 m<sup>2</sup> for 3 months [1]. The final stage of CKD is Kidney failure or End-Stage Renal Disease (ESRD) indicating that the kidney has stopped working permanently [2].

The burden of CKD and its related risk factors remain understudied in developing countries. This would be due to low awareness of the public, health care workers, government and other funders and may lead to the false perception that CKD is not an important

problem in sub-Saharan Africa [3].

In Ethiopia, studies have shown that the burden of CKD among diabetes and hypertension patients is high and treatment options are expensive however the findings vary regarding the prevalence estimate and the available information is insufficient [4, 5]. Efforts to identify the prevalence and potential risk factors of CKD particularly among diabetic and hypertensive patients is indispensable and will be useful in developing effective strategies for the prevention and control of CKD. Therefore, the aim of this study is to assess prevalence and factors associated with CKD among diabetic and hypertensive patients on follow up care at Ambo town public Hospitals, Oromia Region, Ethiopia.

## Methods

A Hospital based cross-sectional study was conducted at Ambo University referral and general hospitals of West Shewa Zone of Oromia Region, Ethiopia. A randomly selected diabetic and hypertensive patients aged 18 years and above, enrolled in secondary care as an outpatient for at least 3 months, with at least one visit in 2020 and one serum Creatinine result were included in the study. Patients with a preexisting diagnosis of CKD, less than eighteen years age, incomplete patient chart, pregnant women, and critically ill patients were excluded from the study.

The sample size was calculated by using both the single and two population proportion formula and the largest is taken. Simple random sampling was used to recruit 308 study participants. Data collection tool was developed to collect information on socio-demographic, disease condition and other potential associated factors using structured questionnaire and was collected by trained health professionals. Participant's knowledge about CKD is measured by calculating the mean score of knowledge questions and those who scored above mean score were regarded as knowledgeable. Patient's chart was reviewed to retrieve information concerning blood pressure, fast blood sugar, serum creatinine and urine albumin level. Then Glomerular filtration rate was calculated using CKD-EPI equation (6) and CKD was defined using eGFR and classified into five stages according to Kidney Disease Improving Global Outcomes(KDIGO)classification system [1].

Data were checked for completeness, coded and entered into Epi info version 7.2.2.6 then exported to SPSS version 23 for statistical analysis. Socio-demographic characteristics of the respondents were presented using descriptive statistics like mean, standard deviation, and proportion. A binary logistic regression analysis was used to examine the association between the potential risk factors and CKD and a p-value of less than 0.05 was used to declare statistical association. Both crude and adjusted odds ratios were presented with a 95% confidence interval.

## Results

### Socio-Demographic Characteristics

A total of 308 diabetic and hypertensive patients were included in the study. Of which, 156 (50.6%) participants were female with mean ( $\pm$  SD) age of  $47.15 \pm 12.06$  years. The majority, 194(63%) study participants were  $\leq 55$  years old, 267 (86.7%) married, 198(64.3%) urban dwellers and 118(38.3%) educated up to elementary level (Table 1).

**Table 1: Socio-Demographic Characteristics of Diabetic and Hypertensive Patients at Ambo Two Public Hospitals of West Shewa Zone, Oromia Region, Ethiopia, 2021**

Variable	Category	Frequency	Percent
Gender	Male	152	49.4
	Female	156	50.6
Age	55 and below	194	63.0
	Above 55	114	37.0
Educational status	No education	93	30.2
	Elementary	125	40.6
	High school	47	15.3
	College and above	43	14.0
Occupation	Gov't employee	33	10.7
	Farmer	103	33.4
	Housewife	73	23.7
	Self-employed	99	32.1
Marital status	Single	15	4.9
	Married	267	86.7
	Widowed	26	8.4
Religion	Orthodox	214	69.5
	Protestant	64	20.8
	Muslim	18	5.8
	Others	12	3.9
Average Monthly income	<1000	203	65.9
	1001-2099	73	23.7
	$\geq 3000$	32	10.4
Residence	Urban	198	64.3
	Rural	110	35.7

### Clinical and Behavioral Characteristics of Diabetic and Hypertensive Patients

Among the study participants, 199(64.6%) had a SBP of 140mmhg or more and 192(62.3%) had DBP of  $>90$ mmhg. Alcohol consumption and family history of CKD was reported by 68(22.1%) and 49(15.9%) study participants respectively. The majority 276(89.6%) of the study participants had body mass index of 18.5 to 24.9 and 296 (96.1%) had no history of smoking.

### Magnitude and stages of chronic kidney disease

The proportions of the study participants with CKD based on Kidney Disease Improving Global Outcomes (KDIGO) stages (by eGFR): 14.3% were G3a, 3.2% were G3b and 2.9% were G4. Sixty-three study participants had  $eGFR < 60$  ml/min/1.73m<sup>2</sup>. The overall prevalence of CKD (stage 3–5) was 20.5% with (95% CI: 16% - 25%). No participants were found to be at stage five or kidney failure (Table2).

**Table 2: Prevalence and Stages of CKD among Diabetic and Hypertensive Patients at Ambo Town Public Hospitals of West Shewa Zone, Oromia Region, Ethiopia, 2021**

Stage of CKD	Description	eGFR (ml/min/1.73m <sup>2</sup> )	Number (%)
G3a	Mildly to moderately decreased	45-59	44(14.3)
G3b	Moderately to severely decreased	30-44	10(3.2)
G4	Severely decreased	15-29	9(2.9)
Total			63 (20.4)

#### Factors Associated with Chronic Kidney Disease

Long duration of hypertension and diabetes mellitus, gender, poor kidney disease knowledge, elevated systolic and diastolic blood pressure, age above 55 years and family history of kidney disease were significantly associated with chronic kidney disease during bivariate analysis. Then multivariable logistic regression analysis was used to identify factors independently associated with chronic kidney disease and statistical significance is declared at p-value of less than 0.05. Accordingly, an association is exhibited between duration of being hypertensive and CKD (AOR=4.89; 95%CI: 1.93, 12.40; P<0.001) and a family history of CKD (AOR=3.36; 95%CI: 1.56, 7.24; P<0.002). Similarly, the ratio of the odds that a patient with CKD had systolic blood pressure of >140 mmHg or lower was 3.2 (AOR=3.20; 95%CI: 1.36, 7.51; P<0.008). There was also an association between CKD and age of the patients (AOR=2.17; 95%CI: 1.09,4.31; P<0.026) (Table 3).

**Table 3: Factors Associated with CKD among Diabetic and Hypertensive Patients at Ambo Town Public Hospitals of West Shewa Zone, Oromia Region, Ethiopia, 2021**

Variables	CKD status		COR(95%CI)	AOR(95%CI)
	Yes N (%)	No N (%)		
Age (Years)				
<55	25(8.1)	169(54.9)	1	
>55	38(12.3)	76(24.7)	3.38(1.90-5.99)	2.17(1.09-4.31)
Sex				
Male	37(12.0)	115(37.3)	1.61(0.92-2.82)	1.18(0.61-2.31)
Female	26(8.4)	130(42.2)	1	
Residence				
Urban	37(12.0)	161(52.3)	1	
Rural	26(8.4)	84(27.3)	1.35(0.76-2.37)	
Systolic BP				
<140	10(3.2)	99(32.1)	1	
>140	53(17.2)	146(47.4)	3.59(1.75-7.40)	3.20(1.36-7.51)
Diastolic BP				
<90	15(4.9)	101(32.8)	1	
>90	48(15.6)	144(46.8)	2.24(1.19-4.23)	1.59(0.73-3.44)
Fasting blood sugar				
<150	44(14.3)	154(50.0)	1.37(0.75-2.49)	
>150	19(6.2)	91(29.5)	1	
Family history				
Yes	43(14.0)	216(70.1)	3.46(1.79-6.68)	3.36(1.56-7.24)
No	20(6.5)	29(9.4)	1	
Duration of HTN				
<5	14(4.5)	111(36.0)	1	
6-10	18(5.8)	85(27.6)	1.68(0.79-3.57)	1.77(0.67-4.68)
>10	31(10.1)	49(15.9)	5.02(2.45-10.25)	4.89(1.93-12.40)
Duration of DM				
<5	23(7.5)	119(38.6)	1	
6-10	22(7.1)	97(31.5)	1.17(0.62-2.23)	0.78(0.32-1.89)
>10	18(5.8)	29(9.4)	3.21(1.53-6.72)	1.49(0.56-3.96)

Alcohol consumption				
Yes	47(15.3)	193(62.7)	1.26(0.66-2.41)	
No	16(5.2)	52(16.9)	1	
CKD knowledge				
Good	16(5.2)	111(36.0)	1	
Poor	47(15.3)	134(43.5)	2.43(1.31-4.53)	1.98(0.96-4.07)

## Discussion

We conducted an institution based cross sectional study and observed that 20.5% (95% CI: 16%-25%) of the study population had CKD. This is found to be in line with other studies but lower than reports from Jimma University Hospital [4-5, 7-8]. These variations could be attributed to differences in the study population, setting, sample size and CKD staging.

Age was significantly associated with chronic kidney disease in this study and it is consistent with most findings and National Kidney Foundation Kidney Disease Outcomes Quality Initiative (K/DOQI) guidelines where more than one-half of the elderly screened for chronic kidney disease had reported to have stages 3-5 CKD (GFR<60 ml/min/1.73m<sup>2</sup>) [4-10]. This might be because of the fact that structural and functional changes that occur in the aging kidneys [11].

Systolic blood pressure >140mmHg was also found to be associated with CKD. This is in agreement [4, 5]. If people with diabetes keep their blood sugar and blood pressure levels within safe limits, their risk of getting CKD can be reduced by 33%-40% [2]. Similarly, Long duration of hypertension (>10 years) was also identified as a factor associated with CKD and this could be explained by the fact that when the disease progress over time, cell function and insulin secretion decreases and this in turn facilitate for advancement of CKD among the patients [12]. It also exacerbate CKD that occurred due to other causes [13]. This finding corresponds with several studies and evidenced by Kazancioğlu R et al. that essential hypertension is generally diagnosed between 25 and 45 years of age but overt kidney dysfunction does not develop unless the patient sustains at least 10 years of uncontrolled hypertension [4, 5, 10].

This study has used and characterized the CKD as per the international guideline using serum Creatinine assessments which is a strength. However, there are couple of limitations to be acknowledged including the use of patient charts to extract information on blood pressure, fasting blood sugar, serum Creatinine and urine albumin level, semi-quantitative urine albumin was measured using urine dipstick and this could not grade level of albuminuria. Lastly, due to cross sectional nature of the study, temporal relationship between risk factors and the outcome cannot be determined and reverse causation cannot be ruled out between variables such as knowledge, Hypertension and CKD.

## Conclusion

In conclusion, the study identified a high prevalence of CKD in patients treated for hypertension and diabetes. Albeit, older age, elevated SBP, a long history of hypertension and family history of kidney disease were found to be associated with chronic kidney disease, we recommend a longitudinal study to explore the etiology of CKD in this population. Early detection and appropriate treatment, awareness creation, and comprehensive preventive activity should be carried out at all levels to reduce CKD and its complications.

## Declarations

### Ethics Approval and Consent to Participate

The study protocol was submitted to and approved by Institutional review board of Saint Paul's Hospital Millennium Medical College. All methods were carried out in accordance with relevant guidelines and regulations. Written informed consent was secured from all the study participants and since all the study participants were above the age of 16 years. LARs of illiterate participants provided informed consent for the study.

**Consent for publication:** Not applicable.

**Availability of Data and Materials:** All data generated or analysed during this study are included in this published article [and its supplementary information files].

**Competing Interests:** The authors declare that they have no competing interests.

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## Author's Contributions

BD was involved in study conception, data analysis, drafting the manuscript. HE, JW, BG and WH were involved in the advising, critically revising, and editing the manuscript for intellectual content. All authors have read and approved the manuscript.

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