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Prevalence, Risk Factors, and Awareness of Chronic Kidney Disease among Diabetes Mellitus and Hypertensive Individuals at the Buea Regional Hospital, Cameroon

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Abstract

Background: Kidney failure, cardiovascular disease, and early mortality are just a few of the major negative effects of chronic renal disease, a serious global health issue. The considerable financial and public health burden associated with chronic kidney disease can be lessened by raising awareness and adopting better practices for its impact, prevention, and early identification. **Objective:** In this study, individuals with hypertension and diabetes were evaluated for their knowledge of chronic kidney disease, its prevalence, and its risk factors. **Method:** It was a hospital-based cross-sectional study conducted on adult (>18 years) patients with diabetes mellitus and hypertension. Each participant provided written informed consent before having their data collected through interviews, medical information, and blood samples for CKD screening. The CKD epidemiology collaboration (CKD-EPI) equation was used to calculate the glomerular filtration rate (GFR) from serum creatinine, and CKD was determined using the estimated GFR (e-GFR). To find independent CKD factors, multivariate logistic regression was employed, with a p-value of 0.05 being regarded as statistically significant. This was accomplished using SPSS (Statistical Program for Social Sciences) version 22.0, IBM Corp., Armonk, NY. **Result:** A total of 156 participants took part in the study among which 95 (60.9%) were male, most of the participants 82 (52.6%) were

aged between 51 - 70 years (mean 59.42 ± 11.007), 76 (48.7%) were unemployed and 97 (62.2%) were single. Overall, the knowledge score of participants on CKD was 65.4% for good knowledge and 34.6% for poor or inadequate knowledge of CKD. More than half of the participants (60%) had chronic kidney disease. Among these, the greatest proportion of CKD patients were those who were hypertensive (88.2%) followed by those who were both hypertensive and diabetic (70.7%). **Conclusion:** There is poor management of CKD in the South West Region of Cameroon which has contributed greatly to the progression of CKD and increases in the mortality rate.

Keywords

Chronic Kidney Disease, Prevalence, Risk Factors, Hypertension, Diabetes Mellitus

1. Introduction

Chronic kidney disease (CKD) is a disorder of the kidney's structure and function that is determined by the glomerular filtration rate (GFR), thresholds for albuminuria, and length of injury [1]. Based on the glomerular filtration rate (GFR), this kidney disease, known as CKD, is divided into five stages, with stage V being the most severe and requiring renal replacement treatment (RRT). The prevalence of CKD is increasing alarmingly over the world and is linked to significant morbidity and mortality, as well as severe health outcomes such end-stage renal disease (ESRD), heart failure, and expensive treatment costs [2].

Moreover, an increase in risk factors such as hypertension, diabetes, hyperlipidemia, obesity, and smoking [3] [4] is to blame for this rising incidence globally. Around 6% of people with essential hypertension also have chronic kidney disease (CKD), which increases their risk of developing the end-stage renal disease (ESRD). According to the Joint National Committee's Seventh Report (JNC 7) and the National Kidney Foundation's Dialysis Outcomes Quality Initiative (NKF-DOQI) recommendations, chronic kidney disease (CKD) is a higher-risk category that necessitates intensive blood pressure management to meet the target blood pressure goal of less than 130/80mmHg [5]. Globally, however, the prevalence of CKD is 13.4% [4] while in Africa, the combined prevalence of CKD is 10.1% in the general population, 24.7% in hypertensive patients, and 16.6% in diabetes mellitus patients [5].

The global burden of disease 2015 study found that CKD was the 17th most fatal illness worldwide and one of the primary causes of death that was growing the quickest. Overall mortality attributable to CKD increased by 31.7% between 2005 and 2015 [3] [6].

Although the prevalence of CKD in the general population in the Central African region ranges from 10.1% to 14.1%, it is the second highest in Sub-Saharan Africa after West Africa [7] [8] [9] [10]. Moreover, between 11.2% and 14.2% of adult Cameroonians had CKD [8] [11]. High rates of hypertension

(31%) [12], diabetes mellitus (6%) [13], and obesity (15%) [14] are present. Due to the high prevalence of CKD, patients are increasingly turning to dialysis and, if appropriate, kidney transplantation for renal replacement therapy. On the other hand, lack of access to dialysis or transplantation causes the death of more than half of all patients in need of renal replacement therapy globally.

A substantial percentage of Africans lack access to renal replacement therapy, especially in middle and east Africa, where less than 3% of those in need of it are treated [8]. Because of this, people with end-stage renal disease continue to die in spite of available treatments, and the burden of CKD is expanding in countries that are least able to deliver dialysis or kidney transplants [9]. Chronic kidney disease (CKD)-related problems can be avoided or decreased with early detection and treatment [10]. Moreover, the majority of CKD cases were not clinically diagnosed, primarily due to patients' ignorance about CKD and its risk factors [15] [16] [17].

Hence, evaluating one's knowledge, attitudes, and practices is a first step in figuring out how much one engages in healthy behaviors [12] [18] [19] [20]. For the early detection of people at risk for CKD, the screening of clinical indications of renal failure is crucial. Also, it is crucial to raise patient awareness in order to improve their lifestyle and stop the disease from occurring. Moreover, patients' comprehension of CKD and medical outcomes are positively impacted by early detection and general education regarding CKD [13] [21]. Therefore, the aim of this work was to determine patient awareness, prevalence, and risk factors for CKD among people with diabetes mellitus and hypertension at the Buea Regional Hospital in Cameroon's southwest region.

2. Materials and Methods

2.1. Study Design and Study Period

It was a hospital based cross-sectional study, within a period of four months from February to June 2022.

2.2. Study Area

This study was carried out in Buea Regional Hospital (BRH), FAKO Division, and South West Region of Cameroon. It is located at the Slope of Mount Cameroon. It has an estimated population of about 90,080 and a surface area of 870 km^2, with the primary language being English. This Hospital is one amongst the five health districts in the Fako Division in the South West Region of Cameroon. The hospital runs a diabetic clinic where diabetic patients gathered every Tuesday of the week, the hospital has a cardiologist, a neurologist and two nephrologists.

2.3. Study Population

The population studied was adult (age ≥ 18 years) diabetes mellitus and hypertensive individuals, seen at the outpatient consultation and specialist consultations at Regional Hospital Buea.

➢ **Inclusion criteria**

The study included patients with 18 years old and above with hypertension and diabetes mellitus.

➢ **Exclusion criteria**

✓ Patients less than 18 years
✓ Illiterate patients
✓ Pregnant women
✓ Critically ill patients.

2.4. Sampling Size Calculation

The Lorentz's method was used to calculate the sample size, which is as follows [22].

$$n = \frac{Z^2 P(1-P)}{d^2}$$

where p = expected prevalence;

Z (constant) = 1.96;

P = Prevalence (18.1%);

e = the precision (0.05);

n = participant.

$$n = \frac{(1.96)^2 (0.181)(1 - 0.181)}{(0.05)^2}$$

Minimum sample size (n) = 188.

2.5. Sampling Method

This was a hospital-based cross-sectional study, where a semi-structured questionnaire was used during the face to face interviewing of patients while administering it, patients information, blood pressure by the use of digital sphygmomanometer, blood sugar levels using blood sugar machine and blood samples were collected from these patients to run their urea and creatinine test, where results of creatinine tested were used to calculate the estimated glomerular filtration rate for the diabetes mellitus and hypertensive patients.

2.6. Ethical Clearance/Consideration

An ethical clearance was obtained from the Institutional Review Board of Faculty of Health Sciences, University of Buea Reference Number: 2022/1843-05/UB/SG/IRB/FHS of the 27 July 2022.

An authorization was also obtained from Regional Hospital Buea Ref: MPH/SW/RDPH/BRH/IRB of the 23 March 2022. Also, authorization was obtained from the Regional Delegation of Public Health Ref Number R11/MINSANTE/SWR/RDPH/PS/702/851 of the 17th March 2022.

2.7. Recruitment Procedure

A consent form and questionnaire were given to participants. In the form, all the

objectives were stated and participants consent was requested before the study. The simple random sampling method was use to recruit the participant.

2.8. Data Collection

Sample Tools

The following tools were used to collect data.

- ✓ Questionnaires for sociodemographic data, knowledge on chronic kidney disease and the risk factors of chronic kidney disease. **See supplementary file**
- ✓ Digital sphygmomanometer for taking of blood pressure.
- ✓ Blood sugar machine to check the blood sugar levels.
- ✓ Vacutainer red tubes, vacutainer needles, cotton, alcohol and gloves to collect blood samples.
- ✓ Reagents to run the urea and creatinine test.
- ✓ Spectrophotometry machine to run the urea and creatinine test.

2.9. Sample Collection

2.9.1. Patient's Information

The information on medications, urea, creatinine, blood pressure, and serum glucose level were collected from the patients. FBS (fasting blood sugar), BP (blood pressure) was used to assess glycemic and blood pressure control, respectively.

2.9.2. Questionnaire

A semi structured questionnaire was developed after reviewing different literatures and used: the first part which was sociodemographic and disease condition, second part was assessing patient's knowledge, and third part, assessing attitude/habit which is risk factors. Average knowledge was considered when at least 4 questions were answered correctly out of 7 knowledge questions, and positive attitude when patients agreed with at least three of the attitude statements. The patient awareness was assessed using knowledge and attitude *i.e.* if they have both average knowledge and positive attitude towards CKD. Using these tools patients were interviewed to obtain respective information when they come for monthly check-up and medication refill.

2.9.3. Laboratory Analysis

Blood was collected from patient's vein in which the serum was obtained to run the urea and creatinine tests.

2.10. Test Procedure

2.10.1. Blood Pressure

- ✓ It was recorded using a digital sphygmomanometer for taking of blood pressure of the hypertensive and diabetic patients where one reading for systolic and diastolic blood pressure was recorded. The activity was repeated twice for confirmation.

✓ The blood pressure helped to classify the patients in different stages of hypertension as follows: grade 1, grade 2, and grade 3.

In grade 1 hypertension, the numbers ranged between:

- **systolic:** 130 - 139 or
- **diastolic:** 80 - 89

In grade 2 hypertension, the numbers ranged between:

- **systolic:** 140 or higher or
- **diastolic:** 90 or higher

Finally, if a person has hypertension grade 3, ranged read:

- **systolic:** 180 or higher
- **diastolic:** 120 or higher

These numbers are for adults since our population was adults.

2.10.2. Fasting Blood Sugar

✓ Blood sugar machine was used to check the blood sugar levels of the hypertensive and diabetic patients with one reading noted. The activity was repeated twice for confirmation.

Blood collection procedure for creatinine and urea tests

Blood was drained from the vein according to standard vein puncture using a vacutainer needle where the red test tubes (No anticoagulant) was connected directly to the needle, the blood sample was allowed to coagulate for some minutes then was centrifuge using the centrifuge machine to obtain the blood serum. The serum creatinine level and blood urea nitrogen were determined using ARCHITECT c8000 by kinetic alkaline picrate.

2.10.3. Creatinine

Five test tubes were labeled as the blank (contains 500 µl of working reagent), standard (500 µl of working reagent and 50 µl of the standard solution), normal (500 µl of working reagent and 50 µl of the normal), pathologic (500 µl of working reagent and 50 µl of the pathologic) and patient laboratory number on the test tube respectively (500 µl of working reagent and 50 µl of patient serum) with the use of a micro pipette. After shaking gently, the blank was passes in the spectrophotometry to zero the machine, followed by the standard to calibrate the machine; thirdly the normal which is a known concentration as well as the pathologic was passed in the machine (The blank, standard, normal and pathologic are control tests which to check the proper functioning of the machine to avoid false positive or negative values) and finally patients sample was passed in the spectrophotometry machine (MINDRAY) which gave an accurate value of creatine in patient serum. The value of creatine for each patient was read on the machine and recorded accordingly. The experiment was repeated twice for confirmation.

The standard value for creatine serum-plasma: men 0.9 - 1.3 mg/dl (80 - 115 µmol/l) and women 0.6 - 1.1 mg/dl (53 - 97 µmol/l) for the picrate reagent (SANYMED).

2.10.4. Urea

The control test was done to ensure proper functioning of the spectrometry machine. The urea has two reagents labeled as reagent (R1) which is the buffer sodium salicylate and reagent two (R2) which is sodium hypochlorite. Test tubes were labeled according to patient laboratory number. In each test tube 500 µl of R1 was pipetted using the micro pipette and 5 µl of patient serum corresponding to its labeled number was added into the test tube containing reagent one (R1) and was then mixed gently and incubated for 5 minutes at 37 degrees Celsius (15 - 25 degree Celsius) in a water bath. After 5 minutes, 500 µl of R2 was pipetted and added into the test tubes in the incubator containing R1 and patient serum and was incubated for another 5 minute at 37 degrees Celsius (15 - 25 degree Celsius), the reaction gave a color change of green indophenol. Finally, the incubated mixture in the test tubes were removed and placed on a tube rack in which each sample was passed in the spectrophotometry machine (EVOLUSION 3000) and each value was recorded accordingly. The experiment was repeated twice for confirmation.

The standard value for serum urea: 15 - 45 mg/dl (2.49 - 7.49 mmol/l) for both men and women according to the reagent CHRONOLAB.

2.10.5. Glomerular Filtration Rate

Patients were diagnosed of CKD by calculating the estimated glomerular filtration rate using serum creatinine and age for each patient and the formula which is as follows [23]. The experiment was repeated twice for confirmation

$$\text{eGFR (mL/min/1.73m}^2\text{)} = 186 \times (\text{SCr}) - 1.154 \times (\text{Age}) - 0.203$$

The different patients were grouped and their prevalence determined based on the Glomerular filtration rate.

2.11. Data Management and Data Analysis

Excel 2010 was used to enter the data, which was then exported to SPSS 22.0 (Statistical Program for Social Sciences), IBM Corp., Armonk, NY for analysis. IBM Corp. (2013) IBM SPSS Statistics for Windows, Version 22.0. IBM Corp., Armonk, NY. The sociodemographic and clinical characteristics of the subjects were presented using descriptive and inferential statistics including percentage, mean, and standard deviation. The relationship between independent variables and CKD was evaluated using bivariate logistic regression, and variables with a p-value of less than 0.18 were taken into account for multivariate logistic regression. To find independent CKD factors, backward conditional logistic regression was performed, and a p-value of 0.05 was deemed significant.

3. Results and Discussion

3.1. Sociodemographic Data

As shown in **Table 1**, below, a total of 156 participants took part in the study among which 95 (60.9%) were male, most of the participants 82 (52.6%) were

age between 51 - 70 years (mean 59.42 ± 11.007), 76 (48.7%) were unemployed and 97 (62.2%) single. Also, most of the participants in this study had attained the secondary level of education (42.7%). Also, 21.1% of the participants reported to be diabetic, 10.9% were hypertensive and the majority (68%) was both diabetic and hypertensive (Table 2).

3.2. Clinical Profile of the Participants

3.2.1. Blood Pressure Measurement

The systolic blood pressure of most participants was <130 mmHg, however 6.4% was >180 mmHg (mean systolic BP = 167.78) (Figure 1). The diastolic blood pressure values of the majority of the participants were less than 85 mmHg and 3.9% had values greater than 110mmHg (mean diastolic BP = 87.85) (Figure 2). See **supplementary file**.

Table 1. Stages of chronic kidney diseases.

Stages of CKD	Estimated GFR (ml/min/1.73m²)	% Of kidney function	Comments
Stage 1	≥90	90% - 100%	There is kidney damage with normal kidney function/proteinuria.
Stage 2	60 - 89	60% - 89%	There is kidney damage with mild kidney function.
Stage 3a	30 - 59	30% - 59%	There is low risk of progression to kidney function. It is a mild to moderate loss of kidney function (3a).
Stage 3b			Also, there is moderate to severe loss of kidney (3b).
Stage 4	15 - 29	15% - 29%	There is high risk to progression of kidney failure. Severe loss of kidney function.
Stage 5	<15	Less than 15%	There is kidney failure.

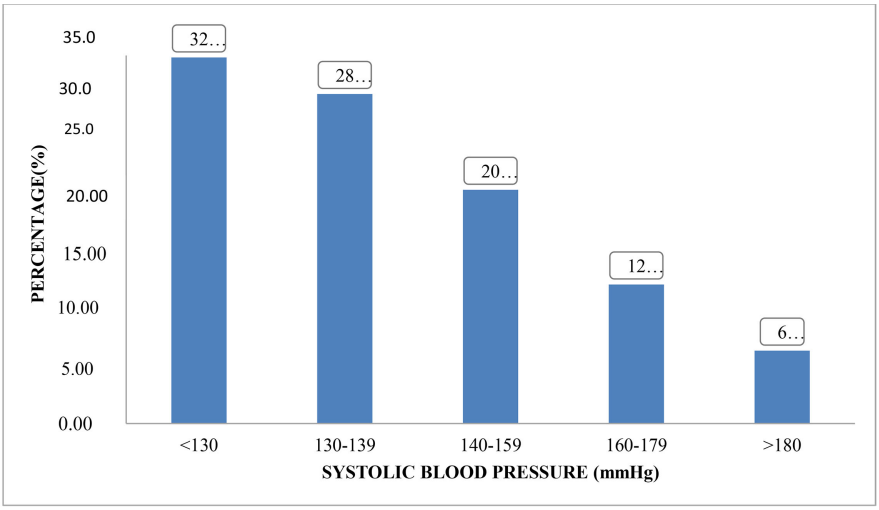

Figure 1. Systolic blood pressure of participants.

Table 2. Socio demographic profile of participants.

Variables	Categories	Frequency (n)	Percentage (%)
Sex	Male	95	60.9
	Female	61	39.1
Age (years)		(mean 59.42 ± 11.007)	
	18 - 29	11	7.1
	30 - 50	35	22.4
	51 - 70	82	52.6
	>71	28	18.0
Occupation	Employed	76	48.7
	Unemployed	46	29.5
	Self-employed	34	21.8
Marital status	Single	97	62.2
	Married	52	33.3
	Divorced	7	4.5
Level of education	Primary	23	14.7
	Secondary	65	41.7
	Tertiary	58	37.2
	No formal education	10	6.4
Chronic disease condition	Diabetes	33	21.1
	Hypertension	17	10.9
	Both	106	68.0
Treatment compliance	Yes	123	78.8
	No	33	21.2
Do you smoke	Yes	32	20.5
	No	124	79.5

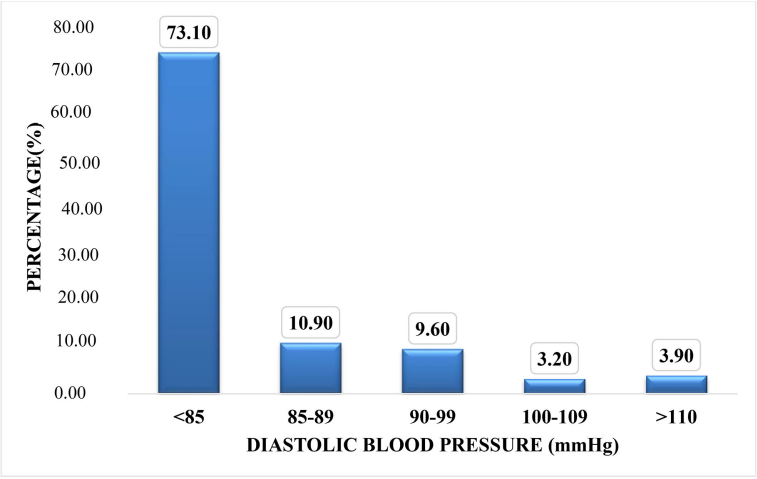

Figure 2. Diastolic blood pressure of participants.

The blood pressure measurement, 34% of the participants were classified as having a normal blood pressure, 14.7% were high normal while 7.7% being grade

3 hypertensions. Also 17.3% had an isolated systolic hypertension as shown on Figure 3 below. **See supplementary file**.

3.2.2. Urea, Creatinine and Estimated Glomerular Filtration Rate

Out of the 156 sample, 44% (68) had a urea level greater than 30 mg/dl (mean = 32 ± 25.72), and 56% (88) had urea level less than 30 mg/dl (Figure 4). See **supplementary file**.

Creatinine measurements showed that the vast majority of the participants had creatinine levels less than 1.3 mg/dl (mean creatinine level 1.82 mg/dl), with 19% above 1.3 mg/dl Figure 5. See **supplementary file**.

From the creatinine level, the estimated glomerular filtration rate was calculated and results show that, most of the participants had an eGFR greater than 90 mL/min/1.73m^2 (CKD stage 1), and 1.3% had a calculated eGFR between 15 - 29 mL/min/1.73m^2 (CKD stage 4). The mean eGFR for the study was 138.291 ± 125.28 mL/min/1.73m^2 (Figure 6). See **supplementary file**.

3.2.3. Fasting Blood Sugar Level

The fasting blood sugar level of the study participants showed that 46% of the participants have FBS level less than 99 mg/dl (normal) and 21% had blood sugar level greater than 126 mg/dl. Mean sugar level of the study was 175 ± 130 mg/dl (Figure 7). See **supplementary file**.

3.2.4. Prevalence of Chronic Kidney Disease

The results of the study showed that more than half of the participants (60%) had a chronic kidney disease based on the classification of the different stages of chronic kidney diseases and the glomerular filtration rate values calculated. Among them, the greatest proportion of CKD patients were those who were hypertensive (88.2%) followed by those who were both hypertensive and diabetic (70.7%), as shown in Figure 8 below. See **supplementary file**.

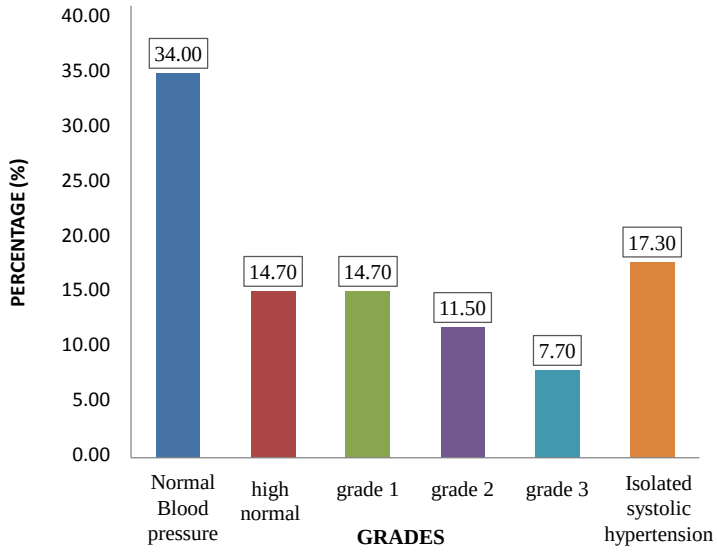

Figure 3. Classification of hypertension of the participants.

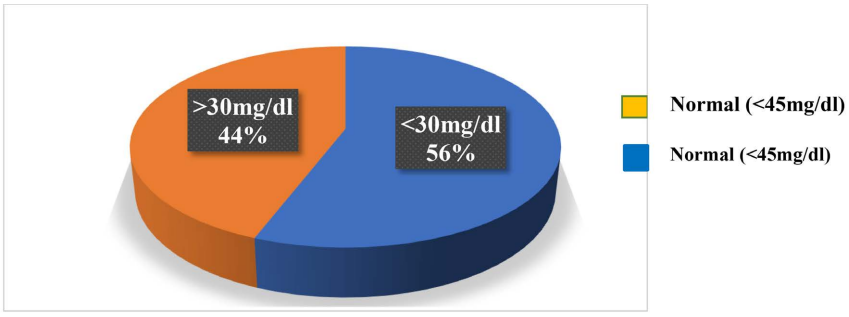

Figure 4. Urea level of participants.

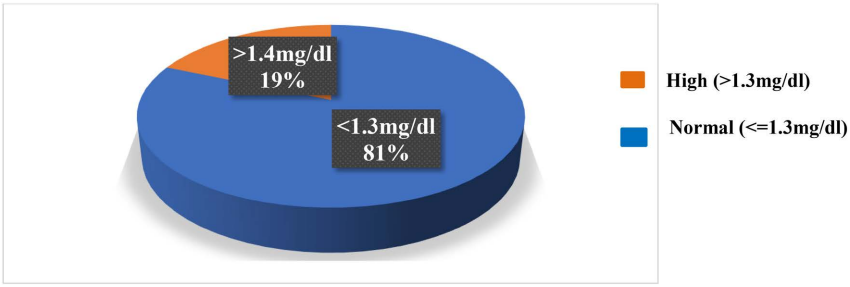

Figure 5. Creatinine level of participants.

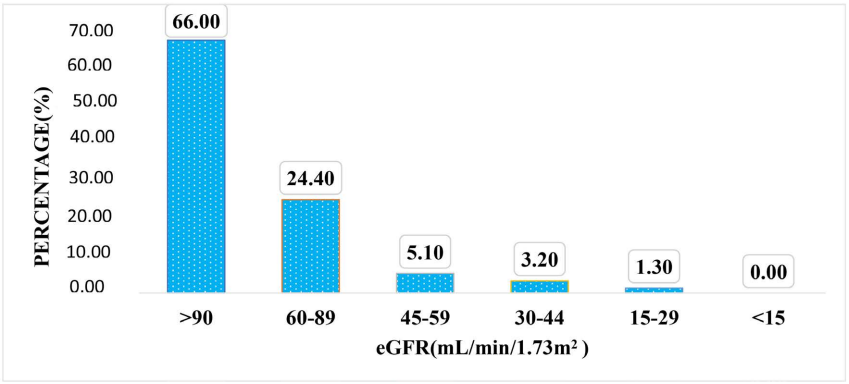

Figure 6. Estimated glomerular filtration rates.

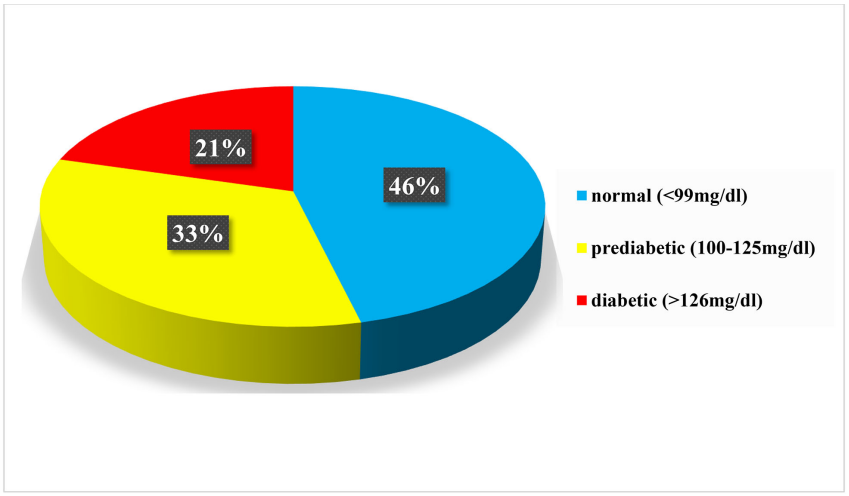

Figure 7. Fasting blood sugar levels.

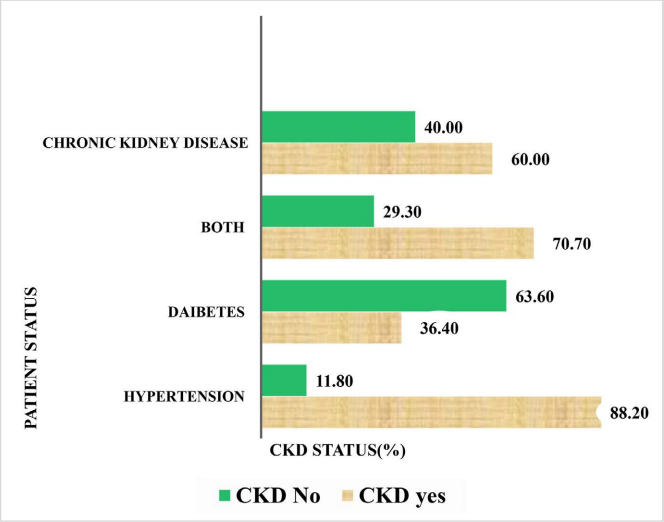

Figure 8. Prevalence of chronic kidney disease in the patient groups.

The bivariate analysis of factors associated with CKD among the study participants showed that, the presence of chronic disease (diabetes, hypertension or both) (p-0.043), compliance to medication (p-0.029) and smoking (0.012) were statistically significant ($p < 0.05$) risk factors for CKD.

3.3. Knowledge on Chronic Kidney Disease (CDK)

Overall, the knowledge score of participants on CKD was 65.4% for good knowledge and 34.6% for poor or inadequate knowledge on CKD (**Figure 9**).

The bivariate analysis of chronic kidney disease for the factors associated with knowledge sociodemographic factors showed no association between the sociodemographic factors and knowledge level of the study participants (**Table 3**).

Factors associated with CKD in **Table 3** include, advanced age, female sex, obesity/adiposity, hypertension, diabetes mellitus, smoking, consumption of alcohol were associated with increased odds of CKD.

4. Discussion

The timing of the association involving risk factors and the outcome could not be established for this study's cross-sectional study design. The definition of CK was based on a single measurement of blood creatinine, and the assessment of knowledge was based on self-report with potential for bias.

In this study, patients with hypertension and diabetes were evaluated for health awareness (knowledge), CKD prevalence, and its predictors. Overall awareness of CKD was high: 65.4% of participants had good knowledge, exceeding the low level of awareness (mean = 3.85) reported from a community survey in Tanzania [24] and the low level of awareness (mean = 27% at the time of the study in Nigeria) [25]. This discrepancy may be caused by variations in the research population's health literacy or in the quantity and nature of the questions asked to gauge patients' knowledge.

Figure 9. Knowledge on chronic kidney disease.

Table 3. Risk Factors associated with the knowledge for chronic kidney disease.

Variables	Good knowledge (n = 102)	Poor knowledge (n = 54)	P-value
Sex			
Male	64	34	0.188
Female	38	22	
Age (years) (mean 59.42 ± 11.007)			
18 - 29	1	11	
30 - 50	24	13	0.280
51 - 70	57	25	
>71	20	8	
Occupation			
Employed	50	26	0.074
Unemployed	31	15	
Self-employed	21	13	
Marital status			
Single	56	41	0.254
Married	43	9	
Divorced	3	4	
Level of education			
Primary	19	4	
Secondary	44	21	0.15
Tertiary	37	21	
No formal education	2	8	
Chronic disease present			
Diabetes	21	12	0.255
Hypertension	10	7	
Both	71	35	
Compliance to treatment			
Yes	76	47	0.130
No	26	7	
Smoking			
Yes	22	10	0.295
No	80	44	

Only 38.5% and 44.2% of participants knew that hypertension and diabetes mellitus, respectively, can lead to CKD; this was lower than the report from Iran, where only 12.7% and 14.4% of respondents chose "unmanaged diabetes" and "unmanaged hypertension," respectively, as "very likely to result in CKD" [26]. This was in line with findings in Nigeria [27], which were 38.3% and 43.6%, respectively. This discrepancy may be the result of the study's community-based versus facility-based settings and its various tools. Whereas the Iranian study employed a Liker scale, while we used dichotomous items.

The prevalence of chronic kidney disease was discovered to be 60%, higher than the reported prevalence of 27.5% from the UK [28], higher than earlier reports from comparable settings, 18.1% from the southern part of Ethiopia [29] and 20.8% from Gondar [30], and higher than the prevalence reported from Spain, where the prevalence of CKD among both diabetic and hypertensive patients was 31.22% [31]. These variations may be the result of different study populations; for example, diabetic patients were the study population in the first two investigations, but huge sample sizes were used in the studies conducted in Spain and the USA. Similar research conducted in Cameroon by [32] found that the prevalence of CKD was substantially greater there (70.8%), with the majority of cases being stage 2 as opposed to stage 1 in our study. According to the eGFR calculation, 1.3% of the individuals had stage 4 CKD. The majority of the prior study, but among people with stage 3 CKD, reported comparable values. Advanced age, increased total cholesterol, and hyperuricemia were all linked to CKD G3-5. This may be due to low awareness of these aspects, which has been found elsewhere, as well as a lack of effective management, as was already highlighted [33]. This suggests that these factors should be routinely screened in such populations, especially the elderly, and that they should be managed as effectively as possible to prevent the progression to end-stage renal disease. Moreover, a sensitization campaign should be undertaken in this situation to boost treatment adherence, raise awareness of the risks associated with anti-inflammatory medicines and obesity, and educate patients on these issues.

This study also found that diabetes, uncontrolled blood pressure (BP > 140/90 mmHg), non-compliance with medication, and uncontrolled blood pressure (BP > 140/90mmHg) were independent predictors of CKD. This finding supports earlier studies that found uncontrolled blood pressure to be associated with a high risk of CKD [32] and that 113 participants (83.0%) had poorly controlled hypertension among those at risk for CKD [34] [35]. It was also consistent with earlier research, which found that long-term, uncontrolled high blood pressure and uncontrolled blood sugar levels were the primary causes of high intraglomerular pressure, which in turn caused impaired glomerular filtration, microalbuminuria, or proteinuria [35]-[40] and chronic kidney disease.

The limitations of this study included some patients answered the questionnaires but did not provide their blood samples for analysis. This was resolved by removing their data from the overall work. Only data containing all the required information was considered for analysis, results presentation and discussion.

5. Conclusions

Our study found out that majority of participant's had good knowledge on chronic kidney disease with many participants not aware that, hypertension and diabetes mellitus are risk factors of CKD. Other risk factors such dietary habit, smoking, lack of exercise, excessive intake of alcohol contribute to the progression of CKD in which many patients leave from mild to severe kidney dysfunction, declining the glomerular filtration rate.

High and uncontrolled blood pressure was a common symptom of chronic renal disease; high fasting blood sugar, persistent hypertension, abstinence from angiotensin-converting converting enzyme inhibitors (ACEIs), and high awareness of CKD were revealed to be independent risk factors.

There is poor management of CKD in underdeveloped countries including Cameroon which has contributed greatly to progression of CKD, with increase in mortality rate.

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Authors Contribution

Patience Nformi Ndapkwi and Elisabeth Zeuko'o Menkem designed, collected data, wrote the manuscript; Elisabeth Zeuko'o Menkem supervised the work; Oteh Njockawoh Mpey analyzed the data; Eleonore Ngounou, Watching Djakissam, Erastus Nembo Nembu, Armel Jackson Seukep, Francis Bomba Taksinkou, Fabrice Fekam Boyom reviewed the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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