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Risk factors for chronic kidney disease among adults in a tertiary hospital community in north-central, Nigeria.

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Abstract

Background: The prevalence of chronic kidney disease (CKD) is on the increase globally with an attendant heavy disease burden and high morbidity and mortality from end-stage renal disease (ESRD). Data on the prevalence of risk factors for chronic kidney disease from sub-Saharan Africa are scanty, more so in the northern part of Nigeria. There are several risk factors for CKD which include, obesity, hypertension, diabetes mellitus and some nephrotoxic agents. Preventive strategy through early detection and treatment has been advocated for CKD especially in our own setting where majority of patients present late and cannot afford the cost of renal replacement therapy which again is not readily available.

Method: This study was conducted among the staff of Bingham University Teaching Hospital (BHUTH), Jos, as part of a screening exercise during the World Kidney Day (WKD) program of 2021, to determine the prevalence of modifiable risk factors for CKD. Adult subjects of 18 years and above, who consented to the study were mobilized after a sensitization talk. The parameters assessed were demographics, body mass index, blood pressures, proteinuria, fasting plasma glucose and plasma creatinine. Glomerular filtration rate (GFR) was estimated using CKD-EPI Creatinine Equation 2021. Data were analyzed using SPSS version 25. The level of statistical significance was set at a p-value of < 0.05.

Results: 150 adult volunteers participated in the study. The mean age of the participants was 43.3±11.32 years (18-71 years), with 61.3% being females and 38.7% were males. The frequency of the risk factors of CKD observed were obesity in 45 (30.0%) of the participants and diabetes mellitus found in 44 (29.3%) of the participants, Proteinuria and glycosuria were found in 49 (32.7%) and 9 (6.0%) of the participants respectively while a whopping 37 (24.7%) of the participants had haematuria. The number of participants found with estimated glomerular filtration rate (eGFR) of <60ml/min/1.73m2 were 55 (36.7%). There was an independent association between older age ($p = 0.010$), being widowed/divorced ($p = 0.041$), and having diabetes ($p = 0.006$) with an eGFR <60ml/min/1.73m^2

Conclusion The prevalence of CKD risk factors in this study population was high. Therefore, there is the need for adequate and continuous sensitization and routine screening in our various clinics for early detection and early management by lifestyle and risk factor modification to halt or reduce the growing burden of CKD with its attendant morbidity and mortality in Nigeria.

Key words: Risk factors, Chronic Kidney Disease, Glomerular Filtration Rate, World Kidney Day Celebration

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Facteurs de risque de maladie rénale chronique chez les adultes dans une communauté hospitalière tertiaire du centre-nord du Nigéria

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Résumé

Contexte général de l'étude : La prévalence de l'insuffisance rénale chronique (IRC) est en augmentation à l'échelle mondiale, avec un lourd fardeau de morbidité et une morbidité et mortalité élevées par insuffisance rénale terminale (IRT). Les données sur la prévalence des facteurs de risque de maladie rénale chronique en Afrique subsaharienne sont rares, surtout dans la partie nord du Nigéria. Il existe plusieurs facteurs de risque d'IRC , notamment l'obésité, l'hypertension, le diabète sucré et certains agents néphrologiques. Une stratégie préventive par la détection et le traitement précoces a été préconisée pour l'IRC, en particulier dans notre propre contexte où la majorité des patients se présentent tardivement et ne peuvent pas se permettre le coût d'une thérapie de remplacement rénal qui, encore une fois, n'est pas facilement disponible.

Méthode de l'étude : Cette étude a été menée auprès du personnel du Bingham University Teaching Hospital (BHUTH), Jos, dans le cadre d'un exercice de dépistage pendant le programme de la Journée mondiale du rein (WKD) de 2021, afin de déterminer la prévalence des facteurs de risque modifiables pour l'IRC. Les sujets adultes de 18 ans et plus, qui ont consenti à l'étude ont été mobilisés après un entretien de sensibilisation. Les paramètres évalués étaient la démographie, l'indice de masse corporelle, la tension artérielle, la protéinurie, la glycémie à jeun et la créatinine plasmatique. Le débit de filtration glomérulaire (GFR) a été estimé à l'aide de l'équation de créatinine CKD-EPI 2021. Les données ont été analysées à l'aide de la version SPSS 25. Le niveau de signification statistique a été fixé à une valeur $p < 0,05$.

Résultat de l'étude: 150 volontaires adultes ont participé à l'étude. L'âge moyen des participants était de 43,3 ±11,32 ans (18-71 ans), 61,3 % étant des femmes et 38,7 % des hommes. La fréquence des facteurs de risque d'IRC observés était l'obésité chez 45 (30,0%) des participants et le diabète sucré chez 44 (29,3%) des participants, la protéinurie et la glycosurie chez 49 (32,7%) et 9 (6,0%) des participants respectivement tandis que 37 (24,7 %) des participants souffraient d'hématurie . Le nombre de participants trouvés avec un débit de filtration glomérulaire estimé (eGFR) de <60 ml/min/1,73 m2 était de 55 (36,7 %). Il y avait une association indépendante entre l'âge avancé ($p = 0,010$), le fait d'être veuf/divorcé ($p = 0,041$) et le diabète ($p = 0,006$) avec un DFGe < 60 ml / min/1,73 m^2

Conclusion : La prévalence des facteurs de risque d'IRC dans cette population d'étude était élevée. Par conséquent, il est nécessaire d'assurer une sensibilisation adéquate et continue et un dépistage de routine dans nos différentes cliniques pour une détection précoce et une prise en charge précoce par modification du mode de vie et des facteurs de risque afin d'arrêter ou de réduire le fardeau croissant de l'IRC avec sa morbidité et sa mortalité au Nigéria.

Mots-clés: Facteurs de risque, maladie rénale chronique, taux de filtration glomérulaire, célébration de la journée mondiale du rein.

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INTRODUCTION

Chronic kidney disease (CKD) is continually receiving public health attention due to its significantly increasing prevalence, the huge burden of human suffering, escalating costs of care, and high mortality from End-stage kidney disease (ESKD) even in developed countries [1]. Chronic kidney disease is defined as a progressive decline of kidney function shown by a glomerular filtration rate (GFR) of less than 60 mL/min per 1.73m^2 as a standalone for three months. It can also be defined as the presence of markers of kidney damage, such as abnormal constituents of urine and/or blood, as well as radiological abnormalities of at least 3 months' duration, irrespective of the underlying cause [2].

Criteria for defining CKD according to the KDIGO 2012 is kidney damage or glomerular filtration rate (GFR) <60ml/min/1.73m^2 for 3 months or more irrespective of cause. Kidney damage in many kidney diseases can be ascertained by the presence of albuminuria, defined as albumin-to-creatinine ratio >30mg/g in two of three spot urine specimens.[3]

The common risk factors for CKD globally include exposure to heavy metals, excessive alcohol consumption, smoking, and the use of analgesic medications as well as advanced age, diabetes, hypertension, chronic glomerulonephritis, and polycystic kidney disease.[4] In Nigeria, the commonest cause of CKD is hypertension, followed by chronic glomerulonephritis and diabetes mellitus. [5]

Chronic kidney disease (CKD) has become a major health concern globally, especially in developing countries with a marked burden in Sub-Saharan Africa [6]. This concern is largely due to the rising prevalence of risk factors such as diabetes mellitus, hypertension, and nephrotoxic agents, the enormous cost implication of its treatment, its role in cardiovascular morbidity and mortality and the fact that the disease largely affects the economically productive younger age groups [6, 7]. Several hospital-based studies in Nigeria have put the prevalence of CKD between 1.6 - 12.4% [8] with a high prevalence of risk factors observed in various studies among different groups [5, 9]. The early stages of CKD (stages 1-3a) may go unnoticed; therefore, the burden of the disease at these early stages goes largely undetected and difficult to assess. The symptoms only begin to manifest when greater than fifty percent of renal functional mass has been lost [10]. Most patients therefore present late to hospital, usually in the advanced diseased states and in need of renal replacement therapy which is not readily available and not within reach of an average Nigerian. As a result, therefore, regular screening to aid early detection of risk factors is paramount in the prevention of CKD and ESRD. This need cannot be over-emphasized.

The aim of this study was to determine the prevalence of risk factors for CKD among adults in a University community in the North Central of Nigeria, for early intervention. Therefore, screening for chronic kidney disease in adults, especially diabetic patients may lead to early detection, evaluation, and treatment. This ultimately can prevent or retard the progression of CKD to ESKD and better quality of life for patients [11]. The rate of diagnosis and public awareness of CKD remains low [12]. However, it has been shown that hypertensive and diabetic patients who are aware of their renal impairment are less likely to progress to ESKD than those who are unaware of their renal status [13].

MATERIALS AND METHODS

This study was undertaken among the staff of Bingham University Teaching Hospital (BHUTH), Jos, as part of a screening exercise during the World Kidney Day program of 2021, to determine the prevalence of modifiable risk factors for CKD.

Bingham University Teaching Hospital (BHUTH), Jos, like other university teaching hospitals in Nigeria has an admix of clinical and non-clinical staff; and students. It is a tertiary care facility that provides several specialist services.

This was a cross-sectional cohort study and convenient sampling method of adult volunteers in a University in the North Central region of Nigeria during the 2021 World Kidney Day exercise. Subjects for the study were mobilized through Bingham University and Bingham University Teaching Hospital authorities. Informed consent was obtained from each of the participants after a session of sensitization seminar on kidney health and chronic kidney disease, “the monster we ignore”. The study participants included doctors (house officers and residents) in internal medicine and family medicine, medical students, nurses, and laboratory scientists all of whom participated both in the screening and in data collection.

Inclusion criterion included all adult members of staff of 18 years and above who consented to the study while the exclusion criterion was those who did not give consent. Demographic data were obtained through interviewer-administered questionnaires and

included age, sex, family and personal/family history of hypertension, diabetes and kidney disease. Weight was measured with a standard measuring scale calibrated in kilograms with subjects standing erect, bare-foot, and without heavy clothing. Height was measured with a stadiometer with subjects standing feet together without shoes or head gear. Body mass index (BMI) was calculated as body weight in kilograms divided by the square of the height in meters. Obesity was defined as BMI $\geq$ 30kg/m^2 according to the WHO guidelines [14]. Blood pressure was measured with a standard mercury sphygmomanometer on the patients' right arm in the seated position with feet on the floor after at least a five-minute rest. Systolic and diastolic blood pressures were taken at Korotkoff phases 1 and 5 respectively to the nearest 2 mmHg. The average of two blood pressure measurements taken five minutes apart was used. Hypertension was defined as SBP $\geq$140mmHg and /or DBP $\geq$ 90mmHg [15].

For biochemical analysis, a sample of five millimeters (5mls) of venous blood was taken from each subject for assessment of serum creatinine. The samples were placed in lithium heparin bottles (gently mixed) and transported immediately to the chemical pathology laboratory. Proteinuria and glycosuria were assessed in subjects' urine using combi-9 dipstick. Proteinuria and glycosuria were defined as the presence of at least 1+ of protein and 1+ of glucose on dipstick respectively.

Random blood sugar was measured using the Accucheck Glucometer, and results were expressed in mmol/l. Hyperglycaemia was defined as fasting blood sugar > 7.1mmol/l (>127.8mg/dl). The Glomerular filtration rate was estimated using the CKD-EPI Creatinine Equation 2021[16] with correction for body surface area (BSA). Body surface area was calculated using the Mosteller's formula in normal weight, overweight and obese adults because of its simplicity and suitability for laboratory and clinical work in adults [17]. Their marital statuses were also grouped into married, single, and widowed/divorced. The participant's level of education was grouped into no formal education/primary, secondary, and tertiary. In addition, their occupation was grouped into attendants, administrators, traders (shop/canteen owners), medical doctors, nurses, and other health workers (comprising pharmacists, laboratory scientists, community health workers, and medical records officers) for the purpose of this analysis.

The other independent variables that were regrouped included the participants' body mass index (BMI) and fasting blood glucose (FBG). The BMI (in kg/m2) was grouped into 18.5 to 24.9 (normal), 25.0 to 29.9 (overweight), and $\geq$30 (obese) [17]. The FBG (in mmol/L) was also grouped into three groups comprising of normal level ($\leq$5.5), pre-diabetes (5.6 – 6.9), and $\geq$ 7.0 (diabetes) [18]. The data collected was analyzed using IBM SPSS version 25. The participants' ages were grouped into 3; those 18 to 39 years were referred to as young adults, 40 to 59 years were middle-aged, and 60 and above were termed elderly for the purpose of analyses. The dependent variable, estimated glomerular filtration rate (eGFR), was classified into 2 categories of either a low (subnormal) value or a normal value using a cut-off value of 60.0 mL/min/1.73m^2. Chi-square analysis was done and the level of statistical significance was set at a p-value of < 0.05.

RESULTS

150 adults were screened at the Bingham University Teaching Hospital, Jos during the 2021 World Kidney Day program. The mean age of the participants was 43.3 ±11.32 years, with 61.3% being females. Table 1 shows the distribution of the participants' socio-demographic characteristics.

Prevalence rate for abnormal eGFR

Table 2 shows the distribution of the participants' clinical correlates. 30% of the participants were obese while 29.3% had abnormally high FBG levels. The number of participants found with a low (< 60 mL/min/1.73m^2) estimated glomerular filtration rate (eGFR) was 55 (36.7%) while those with normal values were 95 (63.3%). Therefore, this study's prevalence rate for low eGFR was 36.7%.

Association between the participants' sociodemographic variables/correlates and eGFR

A chi-square test for the association between the participants' eGFR and their sociodemographic characteristics and correlates is shown in Table 3. From the analysis, the participants' age, marital status, educational level, occupation, and fasting blood glucose (FBG) were significantly associated with their estimated glomerular filtration rates (eGFR).

The variables that were found to be significantly associated with eGFR were subjected to a multivariate logistic analysis to

verify that they were significant predictors and not occurring by chance, as shown in Table 4. Following this analysis, age, marital status, and FBG remained significantly associated with eGFR.

Distribution of identifiable risk factors for CKD

Of the study participants, thirty-two (21.3%) had a history of hypertension. Those that had a positive family history of hypertension, diabetes, and sickle cell disease were 53 (35.3%), 26 (17.3%), and 7 (4.7%) respectively. The results of the urinalysis done for the participants showed that 49 (32.7%) had protein in their urine, 37 (24.7%) had blood, and 9 (6.0%) had glucose in their urine. 63 (42.0%) of the study participants were overweight while 45 (30.0%) were overtly obese. 44 (29.3%) of the participants had diabetes while 73 (48.7%) had prediabetes.

DISCUSSION

World Kidney Day is celebrated every year in the month of March globally just to raise global awareness of the importance of our kidneys to overall health, [19] thereby reducing the frequency of CKD and its attendant morbidity and mortality. Sensitization talks to certain population groups especially vulnerable groups as well screening programs, as we did in this study usually characterize such events. The aim being to identify those at risk of developing chronic kidney disease and the possible obvious risk factors and possibly institute measures to halt or retard progression to chronic kidney disease and end stage kidney [20].

The risk factors of CKD screened for in this population included obesity, hypertension, pre-diabetes, diabetes mellitus, proteinuria, glycosuria, haematuria as well as eGFR. The prevalence of hypertension observed in this study was 21.3%; this falls within the range of the overall prevalence of hypertension in Nigeria reported to be between 8.0- 46.4% [21]. Ordinioha [22] reported a similar prevalence of 21.3% among lecturers in Port Harcourt. Similarly, a report among civil servants in Kano [23] showed a prevalence of 29.8%. Hypertension remains among the top three causes of CKD in Nigeria [24, 25] and is also a common cause of CKD in other parts of Sub-Saharan Africa [10] and when uncontrolled, it is known to hasten the progress of CKD as well as increase cardiovascular complications. This relatively high prevalence of hypertension may be associated with increasing urbanization, and adoption of western lifestyle in this environment as well as the age range screened. Most of the participants screened 51.3% were of middle age of 40-59 years. Also, the stress of marital life with its attendant responsibilities may have also contributed as 76.7% were married while 6% were widowed.

Again, a good number of the participants were either overweight (42%) or obese (30.0%) in the population screened and this fact also may have been a contributory factor to a high prevalence of hypertension we recorded. According to the World Health Organisation (WHO), in 2014, more than 1.9 billion persons worldwide were overweight and of these greater than 600 million were obese [26]. Sub-Saharan Africa is not exempt from the obesity epidemic and Abubakari et al [12] in a review reported an obesity prevalence of 10% among West African adults. In this study, the prevalence of overweight and obesity was comparable to that earlier reported in a systematic review among adult Nigerians [12]. This relatively high prevalence observed in our study may be due to an apparent upsurge in the consumption of fast foods with associated sedentary lifestyles as such may encourage the development of obesity. The commonest risk factors for CKD remain diabetes and hypertension [27, 28] and these conditions are known to be strongly associated with CKD. Overt diabetes in this study was observed in 29.3% of the participants, which is way higher than what was observed in other studies [8,9]. In Port Harcourt, Nigeria, the prevalence of diabetes was reported to be 6.8% among adults [27].

The prevalence of proteinuria in this study was 32.7%. A lower prevalence of 19.4% was reported among civil servants in Kano [23], while a further lower prevalence of 5.6% was observed among civil servants in Bayelsa [8]. This high prevalence observed in this study could be as a result of high prevalence of obesity as well as may be those who presented themselves are those who had some concerns about their health. Proteinuria is an independent risk factor and an early indicator of kidney disease and its persistence is known to be associated with progression of kidney disease [30]. The prevalence of CKD (eGFR< 60mls/min/1.73m^2) 36.7% in this cohort was quite high compared to recent reports in Nigeria [8, 31, 32]. This is due to the relative older people in the study population since it was a convenient sampling method. Secondly, the study is among a cohort of University population who may have one health issue or the other. It is also well known that the

eGFR declines with increasing age. This study also showed a significant negative correlation between age, and eGFR.

CONCLUSION

From this study, 36.7% of the participants had a low eGFR. The participant's age, marital status, occupation, educational level, and FBG were significantly associated with their eGFR. However, following multivariate logistic analysis, being elderly, widowed/divorced, and having a high FBG were independently associated with having a low eGFR. This further highlights the magnitude of CKD in our community and calls for the need to intensify awareness on identifiable risk factors for CKD and preventive measures against the development of CKD.

Recommendations

It is therefore firstly recommended that every adult attending all medical outpatient clinics should be screened for proteinuria, haematuria, and hyperglycemia, as well as documenting their serum creatinine level which should be used to calculate their GFRs.

Secondly, all patients with abnormal constituents of urine and blood with normal GFR and those with GFR <60ml/min/1.73m² with or without abnormal constituents of urine or blood should be on renal failure conservative management to curtail the rising prevalence of ESRD.

Finally, all those overweight/obese with or without diabetes should start lifestyle modification to prevent or at least defer the development of CKD

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Conflict of interest: I hereby declare that there is no conflict of interest in this study.

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Table 1: Distribution of the participants' socio-demographic characteristics (n = 150)

Characteristics	Frequency	Percentages (%)
Age group (years)		
18 – 39	57	38.0
40 – 59	77	51.3
= 60	16	10.7
Sex		
Male	58	38.7
Female	92	61.3
Marital status		
Married	115	76.7
Single	26	17.3
Widow	9	6.0
Level of education		
Tertiary	106	70.7
Secondary	35	23.3
Primary	9	6.0
Occupation		
Attendants	16	10.7
Administrators /civil servants	56	37.3
Other health workers	30	20.0
Medical doctors	4	2.7
Nurses	18	12.0
Students	13	8.7
Traders	13	8.7

Table 2: Distribution of the participants' clinical correlates (n = 150)

Variables	Frequency	Percentage (%)
Body mass index (BMI)		
Normal	42	28.0
Overweight	63	42.0
Obese	45	30.0
Fasting blood glucose (FBG)		
Normal	33	22.0
Pre-diabetes	73	48.7
Diabetes	44	29.3

Table 3: Association between the participant's, risk factors and their eGFR

variables	Estimated Glomerular Filtration Rate (eGFR) Low (%)	Normal (%)	Chi- square, χ^2	p-value
Age groups (years)				
18 – 39	10 (6.7)	47 (31.3)	23.464	**0.0001***
40 – 59	32 (21.3)	45 (30.0)		
≥ 60	13 (8.7)	3 (2.0)		
Sex				
Male	19 (12.7)	39 (26.0)	0.622	0.498
Female	36 (24.0)	56 (37.3)		
Marital status				
Married	38 (25.3)	77 (51.3)	7.977	**0.019***
Single	12 (8.1)	14 (9.3)		
Widow/Divorced	7 (4.7)	2 (1.3)		
Occupation				
Attendants	8 (5.3)	8 (5.3)	13.180	**0.040***
Administrators	13 (8.7)	43 (28.7)		
Other health workers	15 (10.0)	15 (10.0)		
Medical doctors	0 (0.0)	4 (2.7)		
Nurses	10 (6.7)	8 (5.3)		
Students	4 (2.7)	9 (6.0)		
Traders	5 (3.3)	8 (5.3)		
Educational level				
Tertiary	32 (21.3)	74 (49.3)	7.540	**0.023***
Secondary	17 (11.4)	18 (12.0)		
Primary/None	6 (4.0)	3 (2.0)		
BMI				
Normal	19 (12.7)	23 (15.3)	3.322	0.190
Overweight	24 (16.0)	39 (26.0)		
Obese	12 (8.0)	33 (22.0)		
FBG				
Normal	11 (7.3)	22 (14.7)	24.527	**0.0001***
Pre-diabetes	15 (10.0)	58 (38.7)		
Diabetes	29 (19.3)	15 (10.0)		

BMI = Body mass index, FBG = Fasting blood glucose, * = significant p-value

Table 4: Logistic regression variables (Post-hoc analysis) variables

Significant variables	Estimated Glomerular Filtration Rate (eGFR)		
	p –value	AOR	95% CI
Age groups (years)			
18 – 39	0.032	ref	
40 – 59	0.079	0.314	0.086 – 1.145
≥ 60	**0.010***	0.079	0.009 – 0.535
Marital status			
Married	0.089	ref	
Single	0.466	0.530	0.096 – 2.922
Widow/Divorced	**0.041***	0.085	0.008 – 0.906
Occupation			
Attendants	0.175	ref	
Administrators	0.645	1.787	1.151 – 21.12
Other health workers	0.897	1.114	0.217 – 5.718
Medical doctors	0.135	0.239	0.036 – 1.568
Nurses	0.999	71816	0.0000001
Students	0.108	0.185	0.024 – 1.451
Traders	0.369	0.367	0.041 – 3.277
Educational level			
Tertiary	0.153	ref	
Secondary	0.299	0.538	0.167 – 1.731
Primary/None	0.056	0.064	0.004 – 1.071
FBG			
Normal	0.001	ref	
Pre-diabetes	0.482	1.515	0.476 – 4.819
Diabetes	**0.006***	0.173	0.049 – 0.609

AOR = Adjusted Odds Ratio, CI = Confidence Interval,
* = significant p-value, FBG = Fasting blood glucose.