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Assessment of Renal Functions and Determinant Risks of Chronic Kidney Diseases among Health Workers in Northern Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Chronic kidney disease (CKD) is a global public health challenge, particularly in underdeveloped and developing nations. The 2021 World Kidney Day (WKD) exercise held in this study area presented a fantastic chance to assess renal functions and identify risk factors predisposing health workers to kidney diseases.
Methods: Subjects were recruited from among hospital staff during the 2021 WKD exercise. Questionnaires were administered to consented subjects to obtain demographic data, BMI, blood pressure levels were among the characteristics examined. Blood samples were obtained for serum creatinine and fasting plasma glucose and urine was collected for protein and glucose. Glomerular Filtration Rate (GFR) was estimated using the MDRD equation. Data were analyzed using SPSS version 21.0.
Results: The prevalence of CKD was 26%. Alcohol use was observed in 2.3% and tobacco use in 5%; significantly higher in males (8.7%).The use of herbal drugs was seen as 24.2%, higher in males. High BMI was observed in 35.6% of participants, higher in females (47.3%). However, the history of hypertension was higher in males compared to females (25.4% vs 19.4%, p-value =0.331). Mean Serum Creatinine was significantly higher among males (84.6 ± 22.9 mg/dl) than females (2.4 ± 14.0 mg/dl), p-value < 0.001.

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Conclusion: The incidence of chronic kidney disease is rising across the country as seen in our study and some significant risk factors were also identified in this study group. There is a need for periodic assessment of renal functions to forestall the full blow of kidney diseases among health workers.

Keywords: Chronic kidney disease; renal diseases; kidney health; health workers; Katsina Nigeria.

1. INTRODUCTION

Chronic kidney disease (CKD) has emerged as a serious public health concern worldwide, particularly in developing countries, with a particularly high prevalence in Sub-Saharan Africa [1]. This is largely due to the rise in disease conditions such as type 2 diabetes, hypertension, and obesity which are all known common risk factors. The HIV pandemic, with its massive cost implications for treatment, as well as its impact on cardiovascular and renal morbidity and mortality also added to the burden [2]. Risk factors, such as age, gender, race, ethnicity, family history, drug use, smoking, socioeconomic status; and concurrent diseases, such as hypertension and diabetes are traditionally or nontraditionally associated with CKD [3]. The disease primarily affects economically productive people who are usually of younger age group [1,2]. Family members of CKD patients have a high prevalence of CKD and its risk factors. Renal function decreases with age in both men and women. Thus, the elderly population are more prone to develop CKD after various renal insults. One of the strongest yet modifiable risk factors for End stage renal disease (ESRD) in the twenty-first century is obesity [4]. Glomerular hypertrophy and hyperfiltration may accelerate kidney injury by increasing capillary wall tension of the glomeruli and decreasing podocyte density. Obesity may contribute to the pathogenesis of kidney damage through inflammation, oxidative stress, endothelial dysfunction, prothrombotic state, hypervolemia, and adipokine derangements [4]. Moreso, smoking can increase the CKD risk through proinflammatory state, oxidative stress, prothrombotic shift, endothelial dysfunction, glomerulosclerosis and tubular atrophy. Alcohol and recreational drugs have been linked to CKD progression as well as excessive use of analgesic drugs and exposure to heavy metals. Diabetes mellitus (DM) is the leading cause of CKD and ESRD in both developed and developing countries [5-7]. Mechanisms that lead to kidney disease in diabetes include hyperfiltration injury, advanced glycosylation end products, and reactive oxygen species. At the molecular level, numerous cytokines, growth factors and hormones such as transforming growth factor-beta and angiotensin II cause pathologic changes associated with diabetic nephropathy [8-10]. Hypertension has long been a defined risk factor for both CKD and ESRD. systemic hypertension is transmitted to intraglomerular capillary pressure leading to glomerulosclerosis and loss of kidney function; thus, variable risk of impaired renal function has been reported among hypertensive subjects. A history of cardiovascular disease, hyperlipidemia, metabolic syndrome, hepatitis C virus, human immunodeficiency virus infection, and malignancy are further risk factors for CKD [11].

The age-standardized CKD prevalence is 10.4% in men and 10% in women and is higher in low and middle-income countries than in high-income countries. The prevalence of CKD was 16% in West Africa, the highest in the continent. CKD is characterized by young age of patients in Africa, huge morbidity and premature deaths [12-14]. About 90% of patients with CKD die within 90 days of starting dialysis [4]. In Nigeria, a systematic review identified 7 population-based studies, 5 from the Southern part and 2 from the Northern part; in this study, the prevalence of CKD ranged from 2.5 to 26% [3,8,9].

The early stages of CKD are usually asymptomatic, the disease's burden is mainly undiagnosed and difficult to quantify and these are the stages where many healthy individuals belong. When more than half of the renal functional mass has been lost, then the symptoms begin to appear [9]. As a result, most patients present late to the hospital frequently in advanced disease states requiring salvage dialysis.

Early identification of risk factors by routine screening is critical in the prevention of CKD and this gives room for early treatment and reduction in morbidity and mortality. As part of the world kidney day activities held in 2021, this study aimed to identify CKD risk factors among health workers in a tertiary health institution in Nigeria's North-western region.

2. METHODOLOGY

2.1 Study Area and Population

The study was carried out amongst the health workers at the Federal Teaching Hospital Kastina, Kastina State Nigeria. Katsina is a local government area and its the state capital of Katsina State, in Northern Nigeria. It is located 260 kilometres east of the city, of Sokoto and 135 kilometres northwest of Kano, close to the border with Niger Republic.

2.2 Study Design

The study was a cross-sectional descriptive design conducted among volunteer health workers at a health institution in North-Western Nigeria.

2.3 Study Procedure

All volunteered health workers were recruited during the 2021 World Kidney Day exercise. Following a session of health education on kidney health, each participant gave verbal and written informed consent. Clinical assessment was done including general history, clinical examinations, blood pressure, and body mass index (BMI). The BMI was calculated according to WHO criteria, obesity is defined as a BMI of≥30 kg/m2 [10].

The study utilized the average of two blood pressure readings. Systolic blood pressure (SBP) of 140mmHg and/or Diastolic blood pressure (DBP) of 90mmHg were used to characterize hypertension [11]. SBP of ≥140mmHg was considered elevated, and DBP of ≥90mmHg was defined as elevated blood pressure.

A 5mls venous blood specimen was collected into lithium heparin bottles and promptly sent to the chemical pathology laboratory department.Blood samples were centrifuged, plasma obtained were kept at a temperature of -2^0C and creatinine were determined using a modified Jaffe's spectrophotometer. Creatinine ≥1.5mg/dl and eGFR <90mls/1.73 were considered abnormal.

About 15mls urine specimens were also collected into universal bottles for urinary protein, albumin and glucose measurement using a combi-14 dipstick reagent.The detection of 1+ protein, 1+ microalbumin and 1+ glucose on a dipstick was characterized as proteinuria, albuminuria and glucosuria respectively. The Accucheck Glucometer was used to measure random blood glucose levels. Random blood glucose ≥11.1mmol/l (>200mg/dl) was considered as hyperglycemia in the presence of signs and symptoms of Diabetes Mellitus. The Cockcroft-Gault equation[9] was used to calculate the glomerular filtration rate, with body surface area correction (BSA) by using DuBois and DuBois formular [15].

2.4 Data Analysis

The statistical package for social sciences (SPSS) version 21 was used to analyze the collected data. The independent samples T-test was used to compare continuous variables, and the Chi-square test was utilized to analyze categorical variables. The corelation between variables was investigated using Pearson correlation.

3. RESULTS

3.1 Characteristics of Study Participants

A total of 219 healthcare workers consented to participate in this study. There was a male preponderance with a female-to-male ratio of 1:1.35. The mean age was 39.01 ± 10.25 years and did not differ between the male and female participants, p-value = 0.029. The predominant level of education was tertiary (84%) and higher among women (90.3%) than men (79.4%), p-value = 0.005. Alcohol use was seen in 2.3% and tobacco use in 5%; significantly higher in men (8.7%) than women (0%). Use of herbal drugs was seen in about one-quarter (24.2%) of the population and significantly higher in men than women (31.7% vs 14.0%), p-value = 0.002. Similarly, high BMI was seen in 35.6% of participants, higher in women (47.3%) than men (27.0%), p-value = 0.003. However, the history of hypertension was higher in men compared to women (25.4% vs 19.4%, p-value =0.331). Mean Serum Creatinine was significantly higher among men (84.6 ± 22.9 mg/dl) than women (72.4 ± 14.0 mg/dl), p-value < 0.001. For kidney function staging, 77.6% had stage 1 (eGFR> 90), 19.2% were at stage 2 (eGFR; 60 – 90), and 3.2% had stage 3 (eGFR; 45 - 59). Kidney function staging differed by gender (p=0.042) (Table 1).

Table 1. Characteristics of study participants

Characteristics	Overall	Men	Women	P-value
N (%)	219 (100)	126 (57.5)	93 (42.5)	-
Mean Age (SD)	39.01 ± 10.25	38.25 ± 10.09	40.02 ± 10.45	0.209
Level of education	2 (0.9)	0 (0.0)	2 (2.2)	
Primary	33 (15.1)	26 (20.6)	7 (7.5)	
Secondary	184 (84.0)	100 (79.4)	84 (90.3)	*0.005
Tertiary	5 (2.3)	1 (0.8)	4 (4.3)	0.166
Alcohol Use	11(5.0)	11 (8.7)	0 (0.0)	*0.002
Tobacco Use(Male)	53 (24.2)	40 (31.7)	13 (14.0)	*0.002
Use of Herbal	78 (35.6)	34 (27.0)	44 (47.3)	*0.003
drugs(Female)	116.4 (19.7)	118.9 (21.2)	112.8 (16.9)	*0.023
BMI >= 25(Female)	75.2 (12.8)	76.4 (13.4)	73.6 (11.6)	0.108
Mean SBP, mmHg (SD)	50 (22.8)	32 (25.4)	18 (19.4)	0.331
Mean DBP, mmHg (SD)	3 (1.4)	1 (0.8)	2 (2.2)	0.576
Any Hypertension	78.9 (20.4)	84.6 (22.9)	72.4 (14.0)	*<0.001
History of Diabetics				
Mean(SD) serum Creatinine				
Albumin				
Negative	169 (77.2)	101 (80.2)	68 (73.1)	0.482
1+	32 (14.6)	16 (12.7)	16 (17.2)	
2+	18 (8.2)	9 (7.1)	9 (9.7)	
Stages of Kidney function				
> 90 (Stage 1)	170 (77.6)	102 (81.0)	68 (73.1)	*0.042
60 – 90 (Stage 2)	42 (19.2)	18 (14.3)	24 (25.8)	
45 – 59 (Stage 3)	7 (3.2)	6 (4.8)	1 (1.1)	

**p-value < 0.05 indicates significance*

Table 2. Reduced eGFR and albuminuria by characteristics of participants

Variables	Reduced eGFR			Albuminuria		
	Yes	No	p-value	Yes	No	p-value
Mean age ± SD	43.3 ± 9.4	38.8 ± 10.1	0.277	41.9 ± 10.7	38.1 ± 9.9	*0.027
Sex						
Male	6 (4.8)	119 (95.2)	0.243	25 (19.8)	101 (80.2)	0.255
Female	1 (1.1)	92 (98.9)		25 (26.9)	68 (73.1)	
Level of education						
Primary	0 (0.0)	2 (100)	0.622	0 (0.0)	2 (100)	0.101
Secondary	0 (0.0)	32 (100)		3 (9.1)	30 (90.9)	
Tertiary	7 (3.8)	177 (96.2)		47 (25.5)	137 (74.5)	
Alcohol Use	0 (0.0)	5 (100.0)	1.000	0 (0.0)	5 (100.0)	0.591
Tobacco Use	0 (0.0)	11 (100.0)	1.000	2 (18.2)	9 (81.8)	1.000
Use of Herbal drugs	1 (1.9)	51 (98.1)	1.000	10 (18.9)	43 (81.1)	0.573
Family History of	0 (0.0)	3 (100.0)	1.000	0 (0.0)	3 (100.0)	1.000
Diabetics	6 (12.0)	44 (88.0)	*0.001	15 (30.0)	35 (70.0)	0.183
Any Hypertension						
BMI >= 25	6 (7.7)	72 (92.3)	*0.009	18 (23.1)	60 (76.9)	1.000
Total	7 (3.2)	212 (96.8)		50 (22.8)	169 (77.2)	

**p-value < 0.05 indicates significance*

Table 3. CKD by characteristics of participants

Variables	CKD		
	Yes	No	p-value
Age	42.1±10.5	37.9 ± 9.9	*0.008
Sex			
Male	31 (24.6)	95 (75.4)	0.641
Female	26 (28.0)	67 (72.0)	
Level of education			
Primary	0 (0.0)	2 (100)	*0.024
Secondary	3 (9.1)	30 (90.0)	
Tertiary	54 (29.3)	130 (170.7)	
Alcohol Use	0 (0.0)	5 (100.0)	0.330
Tobacco Use	2 (18.2)	9 (81.8)	0.732
Use of Herbal drugs	11 (20.8)	42 (79.2)	0.371
History of Diabetics	0 (0.0)	3 (100.0)	0.569
Any Hypertension	21 (42.0)	29 (58.0)	*0.006
BMI >= 25	24 (30.8)	54 (69.2)	0.265
Total	57 (26.0)	162 (74.0)	-

**p-value < 0.05 indicates significance*

3.2 Prevalence of Albuminuria and Reduced Kidney Function

Of the 219 participants under study, the prevalence of reduced eGFR and albuminuria were 3.2% and 22.8% respectively. While there was no difference in the mean age of participants with and without reduced eGFR, the mean age of participants was higher among participants with albuminuria, p-value = 0.027. Reduced eGFR and the presence of albuminuria were not also associated with gender, p-value > 0.05. Reduced eGFR and albuminuria were not associated with the level of education, alcohol use, tobacco use, use of herbal drugs and history of diabetics, p-value > 0.05. Reduced eGFR was evident in 12% of participants with hypertension, and 7.7% of participants with high BMI (>= 25) (Table 2).

3.3 Prevalence of Chronic Kidney Disease (CKD)

The prevalence of CKD among participants was 26%. Participants with CKD (42.1 ± 10.5) were significantly older than participants without CKD (37.9 ± 9.9), p-value = 0.008. The proportion of participants with CKD did not differ by gender, and the prevalence of CKD was higher among participants with tertiary education (29.3%) compared to secondary (9.1) and primary education (0%), p-value = 0.024. CKD was not associated with alcohol use, tobacco use, herbal drug use, history of diabetics and high BMI, p-value > 0.05. However, CKD was associated with hypertension, p-value = 0.006.

4. DISCUSSION

The topic for world kidney day 2021 was High-Quality Life with Kidney Disease, which aims to enhance education and knowledge about appropriate symptom management as well as empower patients and health care providers. Patient involvement is the ultimate goal of fostering life engagement. Empowerment allows more influence over decision makings and behaviors that have an impact on health [16]. Increasing patient participation in clinical trials and enhancing health literacy communication helps in improving the quality of life and reducing the progression of the disease.

The study recruited two hundred and nineteen health workers with a female preponderance which was in contrast to the findings in a report by Okaka et. al. in the southeastern region of Nigeria where a male preponderance was found [5]. There was not much difference between the age of the male and female participants in this study and the mean age is also similar in both males and females but this is lower as compared to the study done by Okaka et al. [5] whose mean age was 47.52 ± 15.24 as opposed 39.01 ± 10.25. The majority of the participants in this study group were well educated 90.3%.

The CKD risk factors considered in this study were hypertension (HTN), diabetes (DM), obesity and overweight (BMI = 25kg/m2), proteinuria, use of herbal drugs, tobacco use and alcohol use. The prevalence of HTN among study participants was 22.8% which was much lower

compared to 47.1% by Okaka [5], 37.6% by Isara and Okundia [17], 32.3% by Gezawe et-al [18] in north-eastern Nigeria and 32.3% by Ajayi et-al [19] south-western Nigeria among urban slums.These could be due to the fact that most of the participants being healthcare workers and a majority of them are elites and who have access to regular medical check-ups. A probable reason for the lower HTN prevalence in this study compared to all aforementioned might also be due to more awareness of good health education about kidney health and the majority of the participants had tertiary education.

Male participants had higher mean systolic blood pressure 21.2%, and diastolic blood pressure of 16.9% While the female counterpart had lower mean SBP vs DBP (13.4% vs 11.6%) preponderance of HTN in men compared to women can be linked to the preference of sex hormones. This is supported by Ninios et al. [20] who reported a higher prevalence of HTN among post-menopausal women than elderly males.

Obesity and overweight were seen in 78(35.6%) males: females 34 (31.7) vs 44(47.3%), there is a higher proportion of females than males, this was consistent with the study done by Okaka [5] and was also within a reported range from a systematic review of obesity and overweight in Nigeria [21]. Female gender, increasing weight and high socioeconomic status have been reported to be associated with obesity and overweight among Nigerian [22].

Proteinuria and albuminuria were seen among 50 (22.8%) participants and coincidentally hyperglycemia was also observed among the same categories of subjects. Therefore, the mild renal impairment can be explained by background DM nephropathy which has not been diagnosed among these set of people.

The mean serum creatinine in this study was elevated among males 84.6(22.96) and females 72.4(14.00) P-value <0.000. The Prevalence of CKD among participants was 26% which was seen in the majority of the elderly subjects and people with tertiary education, this was higher than the study done by Oluyombo et al. [23] who reported 11–18.8%, although tobacco use, alcohol use and use of herbal drugs were also observed in most of the elderly participant in the study [24].

The study was limited by its cross-sectional design and the nature of recruitment for the selection of participants which were not randomly done. The awareness of kidney disease was also self-reported and concern of recall is importance for a good outcome in patient management.

5. CONCLUSION

The incidence of chronic kidney disease is rising across the country and some significant risk factors were identified in this study group. Increasing age and hypertension were associated with more CKD risk factors among selected participants. There is a need for periodic assessment of renal functions to forestall the full blow of kidney diseases among health workers. We recommend mandatory yearly CKD screening so as to ensure early and appropriate intervention for the treatment of CKD and its risk factors. Also, in view of the cross-sectional nature of our study, we suggest that future prospective studies about the association between knowledge and progression of renal function could be done.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Approval was given by the Ethical review committee of the Federal Medical Center Kastina.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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