Original Article

Albuminuria and Reduced Estimated Glomerular Filtration Rate among First-degree Relatives of Patients with Chronic Kidney Disease in Lagos, Southwest Nigeria

Y. R. Raji, M. O. Mabayoje[1], B. T. Bello[1], C. O. Amira[1]

Department of Medicine, College of Medicine, University of Ibadan, Ibadan, Oyo State, [1]Department of Medicine, College of Medicine, University of Lagos, Idi-Araba, Lagos State, Nigeria

Abstract

Screening of individuals at increased risk of developing chronic kidney disease (CKD) has been advocated by several guidelines. Among individuals at increased risk are first-degree relatives (FDRs) of patients with CKD. There is a paucity of data on the prevalence and risk of CKD in FDRs of patients with CKD in sub-Saharan African population. This study aimed to screen FDRs of patients with CKD for albuminuria and reduced estimated glomerular filtration rate (eGFR). A cross-sectional survey of 230 FDRs of patients with CKD and 230 individuals without family history of CKD was conducted. Urinary albumin: creatinine ratio (ACR) was determined from an early morning spot urine. Glomerular filtration rate was estimated from serum creatinine. Reduced eGFR was defined as eGFR <60 ml/min/1.73 m^2 and albuminuria defined as ACR ≥30 mg/g. A higher prevalence of albuminuria was found in the FDRs compared to the controls (37.0% vs. 22.2%; $P < 0.01$). Reduced eGFR was more prevalent among the FDRs compared with the controls (5.7% vs. 1.7%, $P < 0.03$). Hypertension (odds ratio [OR], 2.9) and reduced eGFR (OR, 9.1) were independent predictors of albuminuria while increasing age (OR, 6.7) and proteinuria (OR, 10.7) predicted reduced eGFR in FDRs. The odds of developing renal dysfunction were increased 2-fold in the FDRs of patients with CKD, OR 2.3, 95% confidence interval, 1.29–3.17. We concluded that albuminuria and reduced eGFR are more prevalent among the FDRs of patient with CKD and they are twice as likely to develop kidney dysfunction as healthy controls.

Keywords: *Albuminuria, chronic kidney disease, first-degree relatives, Nigeria, reduced estimated glomerular filtration rate*

Introduction

Chronic kidney disease (CKD) is a disease of public health importance that is associated with a rising prevalence, and high morbidity and mortality, it also imposes an enormous burden on the individuals affected and the health budgets of most nations of the world.[1] Added to this high burden is the fact that CKD usually go unnoticed in its early stages, and therefore screening of at risk individuals offers the hope of early detection and prompt treatment to retard its progression.[1,2] In sub-Saharan Africa, the diagnosis of end-stage renal disease (ESRD) is generally associated with poor outcome because of limited access to and exorbitant cost of renal replacement therapy (RRT).[3,4]

Early detection of CKD and institution of specific interventions have been shown to slow progression of the disease, maintain quality of life, and improve outcomes.[5-7] Most guidelines recommend screening of individuals at increased risk of developing CKD, this is often achieved through detection of markers of early kidney damage.[8] These high-risk individuals include persons with hypertension, diabetes mellitus, obesity, hyperlipidemia, increasing age, black race, hispanics, and first-degree relatives (FDRs) of patients with CKD. Several studies have shown that there is an increased prevalence of CKD in FDRs of patients with CKD,[9-17] as well as a familial clustering of conditions associated with an increased risk of developing CKD.[18-20]

Screening of FDRs of patients with CKD is a cost-effective way of reaching these at risk individuals and providing them with access to intervention that is potentially lifesaving,[21,22] and likely to lead to a reduction in health-care costs that would have been expended on RRT, especially in sub-Saharan Africa where budgetary allocations to healthcare is still lower than

How to cite this article: Raji YR, Mabayoje MO, Bello BT, Amira CO. Albuminuria and reduced estimated glomerular filtration rate among first-degree relatives of patients with chronic kidney disease in Lagos, Southwest Nigeria. Indian J Nephrol 2018;28:21-7.

Address for correspondence:
Dr. Y. R. Raji, Department of Medicine, Nephrology Unit, College of Medicine, University of Ibadan, Ibadan, Oyo State, Nigeria.
E-mail: yemyrajj@yahoo.com

Access this article online

Website: www.indianjnephrol.org

DOI: 10.4103/ijn.IJN_225_16

Quick Response Code:

the World Health Organization (WHO) recommendations.[23] There is however a paucity of data from sub-Saharan Africa on the risk of CKD in FDRs of patients with CKD. This study aims to determine the prevalence of albuminuria and reduced estimated glomerular filtration rate (eGFR) in FDRs of patients with CKD and also determine the risk of developing kidney dysfunction among this high-risk group.

Materials and Methods

Participants

This was a cross-sectional survey of 230 FDRs of patients with CKD and 230 apparently healthy individuals without personal or family history of CKD. The study was in two phases and recruitments of participants took place between January 3, 2011, and June 30, 2011. The methodology has been fully described elsewhere, only a brief summary is provided here.[24]

In the first phase of recruitment, 106 patients with CKD who were consecutively presenting and consenting patients with CKD attending the nephrology outpatient clinic of the Lagos University Teaching Hospital, Lagos Southwest, Nigeria, were enrolled. In the second phase, the FDRs of 106 patients with CKD were recruited. Following the consent given by the probands, the FDRs were contacted and invited into the hospital through their probands and through phone calls. Moreover, consecutively presenting and consenting FDRs were enrolled in the second phase of the study. A minimum of one and a maximum of 4 FDRs were selected from the family of each proband. Individuals were eligible for recruitment into the FDR arm of the study if they were a parent, sibling, or offspring of the probands, were 18 years of age or older, and gave informed consent. Excluded from the study were individuals with age <18 years, presence of symptomatic urinary tract infection, ongoing febrile illness, presence of heart failure, severe intercurrent illness, or malignancy and a family history of autosomal dominant polycystic kidney disease.

The control arm of the study was recruited from the general population control at a ratio of 1:1, the 230 individuals were consecutively consenting age and gender matched with individuals in the FDR arm, and had no family or personal history of CKD. Inclusion criteria for individuals in the control arm were age 18 years or older, absence of personal or family history of CKD, and giving informed consent. The exclusion criteria for the control arm were similar to those in the FDR arm of the study.

Ethical approval and informed consents

The study protocol was approved by the Health Research and Ethics Committee of the Lagos University Teaching Hospital, and each participating individual gave written informed consent.

Data collection

Information was obtained from the study participants using an interviewer-administered structured questionnaire. Information obtained included the sociodemographic data, personal and family history of kidney disease, a history of diabetes, hypertension, use of herbal medications, nonsteroidal anti-inflammatory agents, cigarette smoking, and alcohol consumption. The weight, height, waist and hip circumferences, and blood pressure (BP) were also measured in each study participant.

Measures of albuminuria and kidney function

Ten milliliter of venous blood and 10 ml of early morning spot urine were obtained from each study participant for determination of serum creatinine and urine albumin: creatinine ratio (ACR), respectively. Serum and urine creatinine were assayed by the modified Jaffe's method using an autoanalyzer (Roche Hitachi 902) while urine albumin was assayed by immunoturbidimetry method using the Randox MA 2426, UK Kit. eGFR was estimated from the serum creatinine using the four-variable Modification of diet in renal disease equation.[25] Albuminuria was defined as ACR ≥30 mg/g while reduced eGFR was defined as eGFR <60 ml/min/1.73 m^2.[26] Moreover, CKD was defined as albuminuria and/or reduced eGFR.[26] The albuminuria and eGFR were measured only once. Other biochemical parameters measured were fasting lipid profile and plasma glucose.

Covariates

Hypertension was defined as systolic BP ≥140 mmHg or diastolic BP ≥90 mmHg, presence of hypertension previously diagnosed by a physician, or use of antihypertensive medications to control BP.[27] Overweight and obesity were defined as body mass index (BMI) of 25–29.9 kg/m^2 and ≥30 kg/m^2, respectively.[28] Truncal obesity was defined as waist circumference >102 cm in male and >88 cm among the female participants.[29] Diabetes mellitus was defined as fasting plasma glucose >7 mmol/L, diabetes mellitus diagnosed previously by a physician or use of antidiabetic medications to control blood sugar, while hyperuricemia was defined as serum uric acid >416.5 μmol/L.[30,31] Dyslipidemia was defined as ratio of total cholesterol/high-density lipoprotein.[32] Moderate alcohol drinking was defined as consumption of at least one drink (14 g) of alcohol per day while moderate to heavy smoking was defined as smoking ≥6 sticks of cigarette per day.[33,34]

Analyses

Data obtained from the study were analyzed using SPSS statistical package, version 17.0 (SPSS Inc., Chicago, IL, USA). Independent sample *t*-tests were used for comparison of group means while Chi-square test was used for comparison of proportions. Mann–Whitney U-test

statistic was used to analyze data that were not normally distributed. Multiple logistic regression analysis was used to determine factors that were independently associated with albuminuria, reduced eGFR, and kidney dysfunction. $P < 0.05$ was considered statistically significant in all situations.

Results

Of the 106 probands with CKD who were recruited in the first phase of the study, 55 (51.9%) were male while 51 (48.1%) were female. Their mean age was 50.4 ± 16.2 years. Table 1 shows the characteristics of the probands with CKD. Table 2 shows a comparison of the clinical and laboratory characteristics of the FDRs of patients with CKD and the control population. Compared to the control group, FDRs of patients with CKD were more likely to have hypertension, diabetes, reduced eGFR, albuminuria, dipstick proteinuria, and more likely to use herbal remedies. They also had higher mean systolic and diastolic BPs, higher mean BMI, and higher mean urine ACRs. CKD defined as albuminuria >30 mg/g and/or reduced eGFR <60 ml/min/1.73 m^2 was observed in 86 (37.4%) FDRs of patients with CKD compared with 54 (23.5%) among the controls, $P < 0.01$.

Table 3 shows a comparison of the clinical and laboratory characteristics of FDRs of patients with CKD with and without albuminuria. FDRs of patients with CKD who had albuminuria were older, more likely to have hypertension and had higher mean systolic and diastolic BPs. After correcting for confounding using logistic regression, only the presence of hypertension (odds ratio [OR], 2.85, 95% confidence interval [CI], 1.47–5.53, $P < 0.01$) and reduced eGFR (OR, 8.95, 95% CI, 1.88–42.94, $P < 0.01$) remained independent predictors of albuminuria among FDRs of patients with CKD. Table 4 shows a comparison of the clinical and laboratory characteristics of FDRs of patients with CKD with and without reduced GFR. FDRs of patients with CKD who had reduced eGFR were older, more likely to have diabetes, dipstick proteinuria, and albuminuria. After correcting for confounding variables using logistic regression, only the presence of dipstick proteinuria (OR, 11.12, 95% CI, 2.26–54.48, $P < 0.01$) and increasing age (OR, 6.20, 95% CI, 1.52–24.7, $P < 0.01$) remained independent predictors of reduced eGFR among FDRs.

The risk of developing renal dysfunction (defined as albuminuria and/or reduced eGFR) in FDRs of patients with CKD compared to the controls was increased by 2-fold (odds ratio 2.3 95% CI, 1.29–3.17). Factors independently associated with being an FDR are CKD, hypertension, dyslipidemia, and herbal consumption [Table 5]. The distribution of CKD in FDRs of patients with CKD was stratified according to the CKD stages in the probands and showed proportional representation in all the three stages of CKD [Table 6].

Table 1: Clinical and demographic characteristic of the probands with chronic kidney disease (*n*=106)

Proband characteristics	Mean±SD/ absolute, *n* (%)
Mean age (years)	50.4±16.2
Gender	
Male	55 (51.9)
Female	51 (48.1)
Proband CKD stages	
Stage III	24 (22.6)
Stage IV	34 (32.1)
Stage V	48 (45.3)
Etiology of CKD in probands	
Hypertension	41 (38.7)
Diabetes mellitus	21 (19.8)
Chronic glomerulonephritis	17 (16.1)
Obstructive uropathy	8 (7.5)
HIVAN	5 (4.7)
Lupus nephritis	3 (2.8)
Analgesic nephropathy	1 (0.9)
Nephrocalcinosis	1 (0.9)
Unknown	9 (8.5)

CKD clinical staging is accordance NKF/KDOQI CKD staging. Stage III: eGFR of 30-59 ml/min/1.73 m^2, Stage IV: eGFR of 15-29 ml/min/1.73 m^2 and Stage V: eGFR <15 ml/min/1.73 m^2. CKD: Chronic kidney disease, HIVAN: Human immunodeficiency virus-associated nephropathy, KDOQI: Kidney disease outcome quality initiative, NKF: National Kidney Foundation, SD: Standard deviation

Discussion

Our study showed that albuminuria (ACR ≥30 mg/g), reduced eGFR (eGFR <60 ml/min/1.73 m^2), CKD, and risk of developing renal dysfunction were significantly higher among the FDRs compared to individual without family history of CKD/ESRD. Albuminuria was more prevalent among the FDRs in this study (37.0%); this finding agrees with previous reports that relatives of patient with CKD/ESRD are at increased risk of developing CKD/ESRD.[9-16] Although the increased prevalence of albuminuria among FDRs in our study was similar to other previous studies, the prevalence of 37% among the FDRs was higher compared to other similar studies. The prevalence of albuminuria in our study was four times higher than in Kidney Evaluation and Awareness Program in Sheffield (KEAPS) study in the United Kingdom where the prevalence of albuminuria among the FDRs was 9.5%.[11] It was also higher when compared to albuminuria of 10.7% reported by Tsai *et al*. among first- and second-degree relatives of patients with CKD in the Taiwanese population.[12] The prevalence of albuminuria was also higher in our study when compared to the prevalence of 9.9% reported by Jurkovitz *et al*. in FDRs among heterogeneous American population.[13] Likewise, Sumaili *et al*. observed a proteinuria prevalence

Table 2: Sociodemographic, clinical and laboratory characteristics of the study populations

Variables	FDRs (*n*=230), *n* (%)	Controls (*n*=230), *n* (%)	*P*
Mean age±SD (years)	33.49±12.0	33.67±12.2	0.87
Gender (female)	115 (50)	115 (50)	0.79
Level of education			
No formal education	3 (1.3)	4 (1.7)	0.70
Formal education	227 (98.7)	226 (98.3)	0.70
Primary education	14 (6.1)	20 (8.7)	0.29
Secondary education	59 (25.7)	40 (18.3)	0.06
Tertiary education	154 (67.0)	164 (71.3)	0.31
Employment status			
Employed	128 (55.7)	133 (57.8)	0.60
Unemployed	35 (15.2)	16 (7.0)	0.01*
Retired	7 (3.0)	4 (1.7)	0.36
Student	60 (26.1)	77 (33.5)	0.84
Mean SBP	116.5±22.5	112.1±18.1	0.02*
Mean DBP	74.9±12.7	71.4±10.5	0.01*
Presence of hypertension	56 (24.3)	29 (12.6)	0.01*
Mean BMI (kg/m^2)	25.5±5.3	23.8±4.0	0.01*
Presence of diabetes mellitus	20 (8.7)	6 (2.6)	0.01*
History of alcohol consumption	58 (25.2)	41 (17.8)	0.05
History of cigarette smoking	14 (16)	6 (2.6)	0.07
Herbal medication use	117 (50.9)	75 (32.6)	0.01*
Fasting plasma glucose (mmol/L)	4.3±1.1	4.3±0.9	0.79
Urinary ACR (mg/g)	22.1 (0.5-1.406)	18.2 (0.6-1.296)	0.02*
Serum uric acid (µmol/L)	239.9±99.4	237.4±81.3	0.85
Serum creatinine (µmol/L)	89.9±23.4	88.3±21.1	0.42
Mean eGFR (ml/min/1.73 m^2)	106.6±28.3	102.3±25.0	0.09
Reduced eGFR	13 (5.7)	4 (1.7)	0.03*
Albuminuria	85 (37.0)	51 (22.2)	0.01*
Dipstick proteinuria	38 (16.5)	11 (4.8)	0.01*

*P<0.05. FDR: First degree relatives of patients with CKD, BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, ACR: Albumin:creatinine ratio, eGFR: Estimated glomerular filteration rate, CKD: Chronic kidney disease, SD: Standard deviation

of 9.7% among FDR of African population in Congo Democratic Republic which was low compared with our finding.[14] Similarly, Xanglie *et al*. and Wei *et al*. reported albuminuria prevalence of 12.7% and 14.4%, respectively, among the FDRs in the Chinese population which was lower compared to our finding.[15,16]

The difference in the prevalence of albuminuria observed in our study could be explained by the difference in the population studied, KEAPS study was carried out in a predominantly Caucasian,[11] likewise Jurkovitz *et al*.[13] Tsai's study was among the Taiwanese population while Xanglie *et al*. and Wei *et al*. studied Chinese population unlike our study that was carried out in a predominantly African population.[12,15,16] Secondly, immunonephelometry method was used in measurement of albuminuria in the KEAPS study, and this method has been shown to underestimate urinary albumin compared to immunoturbidimetry method used in our study.[35] Jurkovitz *et al*. measured proteinuria rather than albuminuria and this is less sensitive and might have been responsible for the low prevalence observed in their study.[13,36] The low prevalence observed by Sumaili *et al*. was probably due to difference in parameter measured; 24 h urinary protein was measured unlike our study where albuminuria was determined by calculating ACR from a spot urine sample which is more sensitive and less prone to sample collection errors.[14,36] In addition, family history of kidney disease was self-reported by the participants in the Congo study, thus prone to recall bias. The higher prevalence of albuminuria in our study could also be due to inclusion of FDRs of patients with Stage III–V CKD unlike other previous studies that included only FDRs of ESRD patients. Hypertension and reduced eGFR were independent predictors of albuminuria among FDRs. Surprisingly, the prevalence of albuminuria (22%) was also observed to be high among the control population, who were individuals without family history of CKD. However, the finding is similar to reports from recent population-based albuminuria screening in Nigeria, where Oluyombo *et al*. and Afolabi *et al*. reported albuminuria prevalence of 18.8% and 45.2%,

Table 3: Factors associated with albuminuria among first-degree relatives of patient with chronic kidney disease

Variables	Presence albuminuria (*n*=85)	Absence of albuminuria (*n*=145)	*P*
Age (years)	36.4±14.0	31.8±10.3	0.01*
Age (>40 years)	29 (34.1)	35 (17.2)	0.01*
Gender (female)	49 (57.6)	66 (45.5)	0.07
Mean SBP (mmHg)	124.8±24.3	111.6±17.5	0.01*
Mean DBP (mmHg)	78.7±14.8	72.6±10.7	0.01*
SBP ≥140 mmHg	27 (31.8)	58 (40.0)	0.01*
DBP ≥90 mmHg	26 (30.6)	59 (40.7)	0.01*
Hypertension	33 (38.8)	52 (35.7)	0.01*
Reduced eGFR	11 (12.9)	2 (1.4)	0.01*
Diabetes mellitus	11 (12.9)	74 (51.0)	0.08
Overweight	47 (55.3)	61 (44.1)	0.50
Obesity	20 (23.5)	20 (13.8)	0.60
Dyslipidemia	21 (24.7)	64 (44.1)	0.08
Alcohol consumption	26 (30.6)	52 (35.9)	0.42
Cigarette smoking	10 (11.8)	13 (9.0)	0.52
Herbal medication use	40 (47.1)	77 (53.1)	0.45
Analgesic use	1 (1.2)	3 (2.1)	0.62

*P<0.05. SBP: Systolic blood pressure, DBP: Diastolic blood pressure, eGFR: Estimated glomerular filtration rate

Table 4: Factors associated with reduced estimated glomerular filtration rate among first-degree relatives of patient with chronic kidney disease

Variables	eGFR		*P*
	<60 ml/min/1.73 m² (*n*=13), *n* (%)	>60 ml/min/1.73 m² (*n*=217), *n* (%)	
Mean age (years)	46.1±17.7	32.7±11.2	0.01*
Age >40 years	9 (69.2)	45 (20.7)	0.01*
Gender (female)	9 (69.2)	106 (48.9)	0.15
Mean SBP (mmHg)	125.5±28.1	116.±22.1	0.14
Mean DBP (mmHg)	78.3±14.7	74.7±12.4	0.29
SBP >140 mmHg	5 (38.5)	8 (3.7)	0.05
DBP >90 mmHg	5 (38.5)	8 (3.7)	0.05
BMI (kg/m²)	28.7±6.7	25.7±5.1	0.06
Hypertension	6 (46.2)	50 (23.0)	0.06
Diabetes mellitus	4 (30.8)	16 (7.4)	0.01*
Albuminuria	11 (84.6)	74 (34.1)	0.01*
Dipstick proteinuria	10 (76.9)	28 (12.9)	0.01*
Overweight	9 (69.2)	99 (45.6)	0.10
Obesity	4 (30.8)	36 (16.5)	0.19
Dyslipidemia	12 (92.3)	159 (73.3)	0.13
Alcohol consumption	3 (23.1)	75 (34.6)	0.40
Cigarette smoking	2 (15.4)	21 (9.7)	0.51
Herbal consumption	6 (46.2)	111 (51.2)	0.73
Analgesic use	1 (7.7)	12 (5.6)	0.74

*P<0.05. SBP: Systolic blood pressure, DBP: Diastolic blood pressure, eGFR: Estimated glomerular filtration rate, BMI: Body mass index

Table 5: Logistic regression of factors associated with being a first-degree relatives of patients with chronic kidney disease

Variables	OR	CI	*P*
CKD	2.31	1.2924-3.1745	0.01*
Diabetes mellitus	1.67	0.36847-2.5638	0.19
Dyslipidemia	1.54	1.0274-2.1376	0.04*
Hypertension	1.82	1.1883-3.9152	0.03*
Herbal consumption	1.83	1.0571-2.7236	0.01*

*P<0.05. CKD: Chronic kidney disease, OR: Odds ratio, CI: Confidence interval

Table 6: Distribution of chronic kidney disease in first degree relatives of patient with chronic kidney disease stratified according to disease stages in the probands

Proband CKD stages	FDRs with CKD (*n*=86), *n* (%)	FDRs without CKD (*n*=144), *n* (%)
Stage III	24 (27.9)	58 (40.3)
Stage IV	29 (33.7)	54 (37.5)
Stage V	33 (38.4)	32 (22.2)

Chronic kidney staging were in accordance with NKF-KDOQI grading of CKD.CKD: Chronic kidney disease and it is defined as albuminuria >30 mg/g and/or reduced eGFR <60 ml/min/1.73 m². FDRs: First degree relatives, KDOQI: Kidney disease outcome quality initiative, NKF: National Kidney Foundation, eGFR: Estimated glomerular filtration rate

respectively.[37,38] The use of only one spot urine sample for diagnosis of albuminuria might have also contributed to the high prevalence among the controls. The high prevalence of albuminuria in our study population buttresses the need to prevent, screen, and treat hypertension as modifiable risk factor for CKD in the FDRs, as well is the general population.

Reduced eGFR (<60 ml/min/1.73 m²) was more prevalent among the FDRs (5.7%) in our study and it was significantly higher than in the control arm of the study (1.7%). The high prevalence of reduced eGFR among FDRs in our study was in agreement with reports from previous similar studies.[5,10-13,16] Xanglie *et al*. reported prevalence of reduced eGFR of 1.5% in FDRs among Chinese population while Wei in a similar population reported a prevalence of 29.9%.[15,16] Xanglie *et al.* finding was at variance with ours and this could be explained by racial difference and mean age of the population studied, though the prevalence of CKD in our study was similar to that reported by Wei.[15.16] Comparing our finding with report from the Kidney Disease Early Evaluation Program (KEEP) study, the prevalence of reduced eGFR in our study was lower (5.7%) compared to 14% reported in the KEEP study.[5,39] The discrepancy could be explained by the difference in the population studied and the mean age of the two groups. The KEEP study was carried out among heterogeneous American population (predominantly Caucasians) who

were at increased risk of CKD and whose mean age was higher (52 ± 15.4 years) compared to our study that was in predominantly African population and with a lower mean age (33.5 ± 12.1 years).[5,39] Their finding was at variance with ours and this could be explained by racial difference and mean age of the population studied.[15,35] Dipstick proteinuria was found to be an independent predictor of reduced eGFR; this finding emphasizes the usefulness of dipstick urinalysis as an important screening tool for CKD and more so that it is cheap and universally available. Increasing age was also observed to be an independent predictor of reduced eGFR among the FDRs; increasing age is well documented risk factor for decline in kidney function in both individuals with normal or disease kidneys.[40,41]

Our study showed that the risk of having CKD among FDRs was increased by 2-fold compared to the individuals without family history of CKD/ESRD. This is higher compared with a report by Lei *et al*. who observed an increased risk of 1.3-fold.[42] The difference in risk of CKD in the two studies could be explained by racial differences; blacks are at increased risk of developing ESRD.[43]

Our study had some limitations which include the fact that it is a cross-sectional study which has its own inherent weakness that include lack of long-term observation of the outcome, difficulty in interpretation of the association between the outcome and the exposure. The diagnosis of albuminuria and reduced eGFR was based on a single laboratory measurement which may be prone to misdiagnosis; the use of single value of reduced eGFR and albuminuria as against 2 or more values that are at least 3 months apart may have led to overestimation of the prevalence of CKD in this study. Since participants with transient causes of reduced eGFR and albuminuria may have been defined as CKD, this constraint was limited by the use of highly sensitive Randox Kit MA 2624 and Roche Hitachi 902 autoanalyzer. More than half of the FDRs in our study were offspring and young people; this could have led to underestimation of the prevalence of albuminuria and reduced eGFR in the FDRs of patients with CKD, since prevalence of CKD increases with age.[37] Finally, our study was unable to differentiate whether it is genetic or environmental factor that is responsible for the high prevalence of albuminuria, reduced eGFR, and high odd of having CKD among the FDRs since not all the participating FDRs lived in the same household with affected family member.

Conclusion

This cross-sectional study of relatives of patients with CKD found a greater prevalence of CKD, albuminuria, and reduced eGFR among the FDR of patients with CKD in black African population in a sub-Saharan Africa community than in the healthy controls. The presence of hypertension serves as a modifiable independent risk factor for albuminuria while the presence of proteinuria and increasing age were found to predict reduced eGFR in FDRs. The risk of CKD is also increased by 2-fold. The findings buttress the need for incorporation of screening of FDRs of patients with CKD for CKD and its risk factors into the preventive health scheme of the countries, especially in the sub-Saharan African countries where budgetary allocation to health is grossly inadequate and RRT is almost not within the reach of most of the ESRD population.

Acknowledgments

The authors acknowledge the contribution of Mr. Anthony Amechi who carried out the laboratory analyses for the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Coresh J, Selvin E, Stevens LA, Manzi J, Kusek JW, Eggers P, *et al.* Prevalence of chronic kidney disease in the United States. JAMA 2007;298:2038-47.
2. Coresh J, Astor BC, Greene T, Eknoyan G, Levey AS. Prevalence of chronic kidney disease and decreased kidney function in the adult US population: Third National Health and Nutrition Examination Survey. Am J Kidney Dis 2003;41:1-12.
3. Sumaili EK, Krzesinski JM, Zinga CV, Cohen EP, Delanaye P, Munyanga SM, *et al.* Prevalence of chronic kidney disease in Kinshasa: Results of a pilot study from the Democratic Republic of Congo. Nephrol Dial Transplant 2009;24:117-22.
4. Alebiosu CO, Ayodele OE. The global burden of chronic kidney disease and the way forward. Ethn Dis 2005;15:418-23.
5. Brown WW, Peters RM, Ohmit SE, Keane WF, Collins A, Chen SC, *et al.* Early detection of kidney disease in community settings: The Kidney Early Evaluation Program (KEEP). Am J Kidney Dis 2003;42:22-35.
6. US Preventive Services Task Force. A Guide to Preventive Health Services: An Assessment of the Effectiveness of 169 Interventions. Baltimore, MD: Williams and Williams; 1989. p. 155-61.
7. Boulware LE, Jaar BG, Tarver-Carr ME, Brancati FL, Powe NR. Screening for proteinuria in US adults: A cost-effectiveness analysis. JAMA 2003;290:3101-14.
8. Lopez-Vargas PA, Tong A, Sureshkumar P, Johnson DW, Craig JC. Prevention, detection and management of early chronic kidney disease: A systematic review of clinical practice guidelines. Nephrology (Carlton) 2013;18:592-604.
9. Inserra F, de la Llave G, Alpino M, Castagna R, de la Fuente I, Dorado E, *et al.* Survey of risk factors and renal disease in first-degree relatives of dialysis patients. Medicina (B Aires) 2007;67:8-18.
10. Freedman BI, Soucie JM, McClellan WM. Family history of end-stage renal disease among incident dialysis patients. J Am Soc Nephrol 1997;8:1942-5.
11. Bello AK, Peters J, Wight J, de Zeeuw D, El Nahas M;

European Kidney Institute. A population-based screening for microalbuminuria among relatives of CKD patients: The kidney evaluation and awareness program in Sheffield (KEAPS). Am J Kidney Dis 2008;52:434-43.
12. Tsai JC, Chen SC, Hwang SJ, Chang JM, Lin MY, Chen HC. Prevalence and risk factors for CKD in spouses and relatives of hemodialysis patients. Am J Kidney Dis 2010;55:856-66.
13. Jurkovitz C, Franch H, Shoham D, Bellenger J, McClellan W. Family members of patients treated for ESRD have high rates of undetected kidney disease. Am J Kidney Dis 2002;40:1173-8.
14. Sumaili EK, Cohen EP, Zinga CV, Krzesinski JM, Pakasa NM, Nseka NM. High prevalence of undiagnosed chronic kidney disease among at-risk population in Kinshasa, the Democratic Republic of Congo. BMC Nephrol 2009;10:18.
15. Xanglie K, Li L, Li Z, Ping Y, Zhongxin L, Wenge L, *et al*. Association between family members of dialysis patients and chronic kidney disease: A multicentre study in China. BMC Nephrol 2013;14:19-25.
16. Wei X, Li Z, Chen W, Mao H, Li Z, Dong X, *et al.* Prevalence and risk factors of chronic kidney disease in first-degree relatives of chronic kidney disease patients in Southern China. Nephrology (Carlton) 2012;17:123-30.
17. Bleyer AJ, Sedor JR, Freedman BI, O'Brien A, Russell GB, Graley J, *et al.* Risk factors for development and progression of diabetic kidney disease and treatment patterns among diabetic siblings of patients with diabetic kidney disease. Am J Kidney Dis 2008;51:29-37.
18. Bergman S, Key BO, Kirk KA, Warnock DG, Rostant SG. Kidney disease in the first-degree relatives of African-Americans with hypertensive end-stage renal disease. Am J Kidney Dis 1996;27:341-6.
19. Freedman BI, Wilson CH, Spray BJ, Tuttle AB, Olorenshaw IM, Kammer GM. Familial clustering of end-stage renal disease in blacks with lupus nephritis. Am J Kidney Dis 1997;29:729-32.
20. Freedman BI, Soucie JM, Stone SM, Pegram S. Familial clustering of end-stage renal disease in blacks with HIV-associated nephropathy. Am J Kidney Dis 1999;34:254-8.
21. Levin A, Hemmelgarn B, Culleton B, Tobe S, McFarlane P, Ruzicka M, *et al*. Guidelines for the management of chronic kidney disease. CMAJ, 2008; 179(11):1154-62.
22. Davison SN, Levin A, Moss AH, Jha V, Brown EA, Brennan F, *et al*. Executive summary of the KDIGO Controversies Conference on Supportive Care in Chronic Kidney Disease: Developing a roadmap to improving quality care. Kidney Int. 2015;88(3):447-59.
23. Naicker S. End-stage renal disease in Sub-Saharan Africa. Ethn Dis 2009;19 1 Suppl 1:S1-13.
24. Raji Y, Mabayoje O, Bello T. Familial clustering of risk factors for cardiovascular disease among first-degree relatives of patients with chronic kidney disease in a sub-Saharan African population. Cardiovasc J Afr 2015;26 2 Suppl 1:S11-4.
25. Levey AS, Bosch JP, Lewis JB, Greene T, Rogers N, Roth D. A more accurate method to estimate glomerular filtration rate from serum creatinine: A new prediction equation. Modification of Diet in Renal Disease Study Group. Ann Intern Med 1999;130:461-70.
26. National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: Evaluation, classification, and stratification. Am J Kidney Dis 2002;39 2 Suppl 1:S1-266.
27. WHO/ISH Hypertension Guidelines; 2005. Available from: http://www.who.int/cardiovascular_diseases/guidelines/hypertension/en/. [Last accessed on 2017 Feb 11].
28. WHO|Obesity and Overweight. World Health Organization Media Centre Fact Sheet No. 311; 2012. Available from: http://www.who.int/mediacentre/factsheets/fs311/en. [Last accessed on 2017 Feb 11].
29. Waist Circumference and Waist-hip Ratio. Report of a WHO Expert Consultation; 2008. Available from: http://www.who.int/nutrition/publications/obesity/WHO_report_waistcircumference_and_waisthip_ratio/en/. [Last accessed on 2017 Feb 11].
30. WHO Guideline on Prevention, Detection and Treatment of Diabetes Mellitus; 2007. Available from: http://www.who.int/diabetes/publications/en/. [Last accessed on 2017 Feb 11].
31. Conen D, Wietlisbach V, Bovet P, Shamlaye C, Riesen W, Paccaud F, *et al.* Prevalence of hyperuricemia and relation of serum uric acid with cardiovascular risk factors in a developing country. BMC Public Health 2004;4:9.
32. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Expert Panel on Detection, Evaluation, and Treatment of High blood cholesterol in adults. J Am Med Assoc 2001;285:2486-97.
33. Morse RM, Flavin DK. The definition of alcoholism. The Joint Committee of the National Council on Alcoholism and Drug Dependence and the American Society of Addiction Medicine to Study the Definition and Criteria for the Diagnosis of Alcoholism. JAMA 1992;268:1012-4.
34. Husten CG. How should we define light or intermittent smoking? Does it matter? Nicotine Tob Res 2009;11:111-21.
35. Thakkar H, Newman DJ, Holownia P, Davey CL, Wang CC, Lloyd J, *et al.* Development and validation of a particle-enhanced turbidimetric inhibition assay for urine albumin on the Dade aca analyzer. Clin Chem 1997;43:109-13.
36. Guh JY. Proteinuria versus albuminuria in chronic kidney disease. Nephrology (Carlton) 2010;15 Suppl 2:53-6.
37. Oluyombo R, Ayodele OE, Akinwusi PO, Okunola OO, Akinsola A, Arogundade FA, *et al*. A community study of the prevalence, risk factors and pattern of chronic kidney disease in Osun State, South West Nigeria. West Afr J Med. 2013;32(2):85-92.
38. Afolabi MO, Abioye-Kuteyi EA, Arogundade FA. Prevalence of chronic kidney disease in a Nigerian family practice population. Fam Pract 2009;51:132-7.
39. Collins AJ, Li S, Chen SC, Vassalotti JA. Participant follow-up in the Kidney Early Evaluation Program (KEEP) after initial detection. Am J Kidney Dis 2008;51 4 Suppl 2:S69-76.
40. Stevens LA, Viswanathan G, Weiner DE. Chronic kidney disease and end-stage renal disease in the elderly population: Current prevalence, future projections, and clinical significance. Adv Chronic Kidney Dis 2010;17:293-301.
41. Rowe JW, Andres R, Tobin JD, Norris AH, Shock NW. The effect of age on creatinine clearance in men: A cross-sectional and longitudinal study. J Gerontol 1976;31:155-63.
42. Lei HH, Perneger TV, Klag MJ, Whelton PK, Coresh J. Familial aggregation of renal disease in a population-based case-control study. J Am Soc Nephrol 1998;9:1270-6.
43. Powe NR. Reverse race and ethnic disparities in survival increase with severity of chronic kidney disease: What does this mean? Clin J Am Soc Nephrol 2006;1:905-6.