

**Original Research Article**

**Associations of Chronic Kidney Disease in a Cohort of Stable First-Degree Relatives  
of Chronic Kidney Disease Patients at a Tertiary Health Facility in South Eastern  
Nigeria**

**ABSTRACT**

**Background:** First degree relatives (FDRs) of chronic kidney disease (CKD) patients have a greater prevalence of the risk factors for CKD than the general population and should be screened for kidney disease. There is paucity of local data on associations between the risk factors for CKD and the occurrence of CKD in the stable FDRs of CKD patients.

**Methodology:** This was an observational prospective study involving 150 FDRs of CKD patients carried out in Nnewi, South-east Nigeria.

The subjects were screened for CKD using urine albumin creatinine ratio (uACR) and estimated Glomerular filtration rate (eGFR). These were repeated after three months for the FDRs with initial abnormal results. Risk factors for CKD that included hypertension, diabetes mellitus (DM), obesity and dyslipidaemia were also assessed.

**Results:** The risk factors for CKD that included age, gender, hypertension, cigarette smoking, heavy alcohol consumption, dyslipidaemia, hypercholesterolaemia and hyperuricaemia were found to have significant association with the occurrence of CKD in the FDRs of CKD patients ( $P < 0.001$ ;  $P < 0.038$ ;  $P < 0.001$ ;  $P = 0.008$ ;  $P < 0.001$ ;  $P < 0.01$  &  $P < 0.001$  respectively).

There was no significant association between CKD and DM and herbal medication use ( $P = 0.782$  &  $P = 0.081$  respectively).

Logistic regression analysis showed that age ( $P = 0.009$ , OR 1.079, 95% C.I = 1.019 – 1.141), hypertension ( $P = 0.004$ , OR 10.602, 95% C.I = 2.085 – 53.920), and heavy alcohol consumption ( $P = 0.003$ , OR 12.657, 95% C.I = 2.316 – 69.159) were independent predictors for CKD among the FDRs.

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**Conclusion:** Age, gender, hypertension, significant cigarette smoking, heavy alcohol consumption, dyslipidaemia, hypercholesterolaemia and hyperuricaemia were significantly associated with the occurrence of CKD in FDRs of CKD patients while age, hypertension and heavy alcohol consumption were independent predictors of CKD in this group of subjects.

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**Keywords:** Associations; chronic kidney disease; first degree relatives; stable.

## INTRODUCTION

Chronic kidney disease (CKD) can be defined as the presence of kidney damage or an estimated glomerular filtration rate (Egfr) less than 60 ml/min/1.73 m<sup>2</sup>, persisting for 3 months or more, irrespective of the cause<sup>1</sup>. It is a notable public health concern in both developing and developed countries and a risk factor for adverse outcomes in other diseases<sup>2</sup>. CKD is a preventable condition with risk factors that are non-modifiable or modifiable<sup>3</sup>. The non-modifiable risk factors are older age, male sex, African origin, and family history of CKD<sup>3</sup>. The modifiable risk factors are diabetes mellitus, hypertension, proteinuria, obesity, dyslipidaemia, hyperuricaemia and prolonged use of non-steroidal anti-inflammatory drugs<sup>3</sup>. First degree relatives of CKD patients have a greater prevalence of the risk factors for CKD than the general population and therefore should be screened for kidney disease<sup>4</sup>.

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Also mortality rate and DALY due to CKD may be included to showcase the seriousness of the condition

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A study identified age, female gender, hypertension, regular intake of herbal remedies and diabetes mellitus as significant risk factors for CKD, while some other studies have reported various associations between the risk factors for CKD and undiagnosed CKD among the apparently healthy first-degree relatives (FDRs) of CKD patients<sup>5</sup>. Schaeffner *et al*, reported that elevated total cholesterol (TC), a high ratio of TC/HDL and low HDL were significantly associated with increased risk of developing renal dysfunction in apparently healthy men<sup>6</sup>. Still another study found a significant association between low levels of HDL and risk of incident CKD and CKD progression while the Framingham Offspring cohort study found that of 2585 participants without preexisting kidney disease, higher body mass index (BMI) was associated with higher risk of developing CKD<sup>7,8</sup>.

Bagchi *et al* in India found that older age, female sex, proteinuria and uncontrolled blood pressure were significantly associated with eGFR < 60ml/min/1.73m<sup>2</sup> while Wei *et al* in Southern China found that older age, female gender, hypertension, hyperglycaemia, hyperuricaemia, hypertriglyceridaemia, low HDL, increased body mass index and nephrotoxic medications were independently associated

with increased risk of CKD<sup>9,10</sup>. Similarly, hyperuricaemia and cigarette smoking were reported to be independent risk factors for CKD development and progression in two separate studies<sup>11,12</sup>.

In developing countries like those of the sub-Saharan Africa, there is shortage of dialysis and renal transplant facilities which are the treatment options for end stage renal disease (ESRD). This, coupled with the trajectory rise the CKD cases due to increasing number of hypertensive and diabetic patients globally underscores the need for early detection, treatment and reversal of the modifiable risk factors for CKD in FDRs of CKD patients. This will not only reduce the occurrence of CKD and slow down its progression to ESRD, but will also reduce the economic burden of CKD globally.

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This study was aimed at determining the associations between the various risk factors for CKD and hitherto undiagnosed CKD among the FDRs of the CKD patients and thereby answering the research question: are there associations between the various risk factors CKD and the occurrence of CKD in FDRs of CKD patients?

## **MATERIALS AND METHOD**

### **Study Design and Setting**

This was an observational prospective study on consenting adult first degree relatives of patients with CKD at Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi, Anambra State, South-Eastern Nigeria.

The study was conducted at the Nephrology Outpatient Clinic and Haemodialysis unit of NAUTH from September 2018 to August 2019.

### **Study Population**

The participants for the study comprise the first-degree relatives (parents, siblings and children) of CKD patients at NAUTH.

### **CKD probands selection**

All the CKD patients (with eGFR < 60ml/min/1.73m<sup>2</sup>) that attended Nephrology Outpatient Clinic and haemodialysis unit of NAUTH, were identified. The study purpose and benefits of early CKD detection and prevention among their family members were explained to them. Consecutive recruitment of 54

CKD patients that consented was done using a simple random sampling. Information on the diagnosis of their CKD and presumed aetiology was obtained from the hospital records.

### Study subject selection

The study subjects were selected among the first-degree relatives (parents, siblings and children) of the CKD patients. Three first degree relatives of each of the 54 CKD probands were selected via balloting. A pool of the names of the FDRs of CKD patients was made and a possible three selected by balloting, giving a total of 162 study subjects. Selected FDRs were invited for the study by the CKD patients themselves. 162 FDRs commenced the study, while 12 were lost to follow-up and 150 completed the study.

The study subjects were seen on two occasions: at the baseline visit and at the follow-up visit. At the baseline assessment, the study questionnaire was filled, anthropometric and blood pressure measurements done and blood and urine samples were collected.

The follow-up visit was scheduled 3 months later for the subjects with estimated GFR < 60ml/min/1.73m<sup>2</sup> and/or urine ACR < 30mg/g at the baseline assessment. Follow up tests done were serum creatinine and urine ACR.

### Inclusion and Exclusion Criteria for The Study Subjects

Consenting First degree relatives (FDR) of CKD patients aged 18 years and above were recruited into the study while those that were pregnant, had a febrile illness, urinary tract infection, clinical heart failure or retroviral disease were excluded from participation in the study.

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### Instruments and Measurements

A researcher-structured questionnaire was used to extract relevant clinical and socio-demographic data that included age, gender, marital status, occupational, educational and lifestyle history such as smoking and alcohol consumption. Weight was measured in kilograms to the nearest 0.1 kg using a weighing scale and height in meter with a stadiometer. Waist circumference was measured with a non-stretch metric tape to the nearest 0.1 centimeters at the midpoint between the iliac crest and lower coastal margin. Body mass index (BMI) was calculated as weight (in kg) divided by square of

the height (in meters). Blood pressure was measured on the right arm using an Accoson mercury sphygmomanometer (Dekamet, England).

### **Sample Collection and Analysis**

After an overnight fast based on pre-information, 6mls of blood was collected from each study subject. 1 ml of blood was dispensed into a fluoride oxalate container for fasting plasma glucose analysis. The remaining 5 ml of blood was dispensed into a sterile plain container and allowed to clot and retracted. The blood was centrifuged at 3000 rpm for 10 minutes and the serum separated into two aliquots and stored at -20 °C. The analysis of all the biochemical parameters was done within one month of collection. The biochemical parameters analyzed were serum creatinine, serum uric acid, fasting lipid profile (triglyceride, total cholesterol, high density lipoprotein and low-density lipoprotein cholesterol) and retroviral screening. Samples were analyzed by a medical laboratory scientist at the laboratory of Nnamdi Azikiwe University Teaching Hospital.

The serum creatinine was determined using Jaffe method<sup>13</sup>. Serum uric acid was determined using colorimetric method<sup>14</sup>. Fasting plasma glucose was assayed colorimetrically using glucose oxidase method<sup>15</sup>.

Urine samples were collected between 7am and 10am in the morning. Urinalysis was done using Combi 10 dipsticks to check for proteinuria and infection. Positive nitrite or leucocyte test indicated presence of urinary tract infection.

Retroviral screening was done using determine kit (Alere Determine™ HIV- 1/2, LOT 87029K100A, Japan).

Urinary albumin was estimated using turbidimetric immunoassay method (Lot No 30030164, AGAPEagent, Switzerland). Urinary creatinine was measured using Jaffe method<sup>13</sup>. Urinary albumin-creatinine ratio was calculated in milligram of albumin per gram of creatinine and results were interpreted as follows: less than 30mg/g was regarded as normal, between 30-300mg/g was regarded as moderately increased and greater than 300mg/g was regarded as severely increased<sup>16</sup>.

The estimated glomerular filtration rate (eGFR) was calculated using the Modification of Diet in Renal Disease (MDRD) formula. This is available online at: [www.kidney.org/kls/professionals/gfr/calculator.cfm](http://www.kidney.org/kls/professionals/gfr/calculator.cfm). The equation is stated below:

$186 \times (\text{serum creatinine in mg/dl})^{-1.154} \times (\text{age in years}) \times 0.742 \text{ (for female)} \times 1.210 \text{ (for blacks)}^{17}$ .

### Data Analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 21.0 (IBM Software Group, 200W. Madison St., Chicago, IL; 60606 USA). Categorical data was presented as frequency and percentage. Test of associations was done using Chi square tests for categorical variables. Logistic regression analysis was used to determine the independent risk factors for CKD among FDRs. Results were presented in tables. P value < 0.05 was considered statistically significant.

### DEFINITION OF OPERATIONAL TERMS

1. Chronic kidney disease was defined as estimated GFR < 60ml/min/1.73m<sup>2</sup> for > 3 months with or without evidence of kidney damage or if there was an indicator of kidney damage like albuminuria – in this study albuminuria was defined as urine albumin creatinine ratio (ACR) ≥ 30mg/g for > 3months<sup>16</sup>.
2. Hypercholesterolaemia – total cholesterol ≥ 5.2 mmol/l<sup>18</sup>.
3. Dyslipidaemia – total cholesterol/HDL ratio ≥ 5<sup>18</sup>.
4. Hyperuricaemia – serum uric acid ≥ 420µmol/l (7.0 mg/dl)<sup>19</sup>.
5. Diabetes mellitus – defined as fasting plasma glucose of ≥ 7.0mmol/l (126mg/dl) or previous diagnosis of diabetes mellitus or individuals taking anti-diabetic agents<sup>20</sup>.
6. Significant cigarette smoking – defined as smoking 20 cigarettes daily for more than one year<sup>21</sup>.
7. Heavy alcohol consumption – defined as consumption of >210grams of alcohol per week<sup>22</sup>.
8. Analgesic abuse – defined as cumulative lifetime use of more than 5000 pills of analgesics<sup>23</sup>. This will be calculated from multiplying the average number of pills consumed in a week by the duration of use in years<sup>23</sup>.

9. Truncal obesity was defined as waist circumference  $\geq 102\text{cm}$  in males and  $\geq 88\text{cm}$  in females<sup>24</sup>.
10. Underweight was defined as BMI  $< 18.5$ , normal weight was defined as BMI of 18.5 to 24.9, overweight was defined as BMI of 25 to 29.9 and obesity was defined as a BMI  $\geq 30$ <sup>25</sup>.
11. Hypertension was defined as a systolic blood pressure  $\geq 140\text{mmHg}$  or diastolic blood pressure  $\geq 90\text{mmHg}$  or use of antihypertensive medication for blood pressure control or history of hypertension<sup>26</sup>.
12. Proband refers to a person in a family affected with a disease or condition that raises suspicion that other family members may have an increased propensity for the same disease or condition<sup>27</sup>.

## RESULTS

A total of 150 FDRs completed the study. The FDRs were made up of 69 (46.0%) males and 81 (54.0%) females and their mean age was 36.0 years. Also, majority, 72 (48.0%) of the FDRs were children of the CKD patients, 54 (36.0%) were siblings and 24 (16.0%) were parents of CKD patients. The prevalence of CKD among the FDRs was 26.7%.

### Association between CKD in the FDRs and the risk factors

Risk factors that had significant association with development of CKD in FDRs included age, gender, hypertension, cigarette smoking, heavy alcohol consumption, dyslipidaemia, hypercholesterolaemia and hyperuricaemia (Table 1).

There was no significant association between CKD and DM and herbal medications use (Table 1).

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**Table 1: Association between CKD in the FDRs and the risk factors at baseline**

Variable	CKD	Test Stat	p-value
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		Present	Absent		
<b>Median age (and IQR) in years</b>		50.0 (15.5)	30.0 (18.5)	<b>U =715.0</b>	<b>&lt; 0.001*</b>
<b>Gender</b>	Male	24 (60.0)	45 (40.9)	$\chi^2= 4.304$	<b>0.038*</b>
	Female	16 (40.0)	65 (59.1)		
<b>Hypertension</b>	Present	28 (70.0)	6 (5.5)	$\chi^2= 69.717$	<b>&lt; 0.001*</b>
	Absent	12 (30.0)	104 (94.5)		
<b>Diabetes Mellitus</b>	Present	6 (15.0)	13 (11.8)	$\chi^2= 0.268$	0.782
	Absent	34 (85.0)	97 (88.2)		
<b>Significant Cigarette Smoking</b>	Present	7 (17.5)	4 (3.6)	$\chi^2= 8.296$	<b>0.008*</b>
	Absent	33 (82.5)	106 (96.4)		
<b>Heavy alcohol consumption</b>	Present	17 (42.5)	9 (8.2)	$\chi^2= 24.110$	<b>&lt; 0.001*</b>
	Absent	23 (57.5)	101 (91.8)		
<b>Herbal medication</b>	Present	10 (25.0)	14 (12.7)	$\chi^2= 3.287$	0.081
	Absent	30 (75.0)	96 (87.3)		
<b>Dyslipidaemia</b>	Present	26 (65.0)	13 (11.8)	$\chi^2= 43.120$	<b>&lt; 0.001*</b>
	Absent	14 (35.0)	97 (88.2)		
<b>Hypercholestromia</b>	Present	25 (62.5)	15 (13.6)	$\chi^2= 35.815$	<b>&lt; 0.001*</b>
	Absent	15 (37.5)	95 (86.4)		
<b>Hyperuricaemia</b>	Present	17 (42.5)	14 (12.7)	$\chi^2= 15.859$	<b>&lt; 0.001*</b>
	Absent	23 (57.5)	96 (87.3)		

U= Mann-Whitney U test applied.  $\chi^2$ = Chi square. \* = statistically significant

### Predictors of CKD in the FDRs

After logistic regression analysis, age (OR 1.079), hypertension (OR 10.602), and heavy alcohol consumption (OR 12.657) were found to be independent predictors for CKD among the FDRs (Table 2).

**Table 2: Logistic regression of CKD and the independent risk factors**

Variable		Slope	AOR	95% C.I.	p-value
<b>Age in years</b>		0.076	1.079	1.019 – 1.141	<b>0.009*</b>
<b>Gender</b>	Male	-0.330	0.719	0.164 – 3.144	0.661
	Female	Reference	-	-	
<b>Hypertension</b>	Present	2.361	10.602	2.085 – 53.920	<b>0.004*</b>
	Absent	Reference	-	-	
<b>Significant Cigarette Smoking</b>	Present	-0.433	0.648	0.056 – 7.472	0.728
	Absent	Reference	-	-	
<b>Heavy alcohol consumption</b>	Present	2.538	12.657	2.316 – 69.159	<b>0.003*</b>
	Absent	Reference	-	-	
<b>Hypercholesterolaemia</b>	Present	0.598	1.819	0.196 – 16.879	0.599
	Absent	Reference	-	-	
<b>Dyslipidaemia</b>	Present	0.369	1.447	0.141 – 14.864	0.756
	Absent	Reference	-	-	
<b>Hyperuricaemia</b>	Present	-0.600	0.549	0.125 – 2.416	0.428
	Absent	Reference	-	-	

<b>Constant</b>	-5.333	0.005	-	-	< 0.001
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\* = statistically significant, AOR = Adjusted Odd Ratio.

## DISCUSSION

### Association between the risk factors for CKD and occurrence of CKD in the FDRs

This study found that age, gender, hypertension, cigarette smoking, heavy alcohol consumption, dyslipidaemia, hypercholestraemia and hyperuricaemia had significant association with the risk of development of CKD in the FDRs of the CKD subjects.

Some other studies had similar findings. Shankar *et al* found significant association between heavy alcohol consumption and the development of CKD in the FDRs of CKD patients<sup>28</sup>. On the other hand, Koning *et al* reported an inverse association of alcohol consumption and the risk of development of CKD in the FDRs of CKD patients<sup>22</sup>. In their study of 620 CKD patients, Sertu *et al* found that urinary tract obstruction, hypertension, diabetes mellitus, cardiovascular disease and family history of CKD were positively associated with CKD<sup>29</sup>. Li *et al* found that older age. Male gender and obesity were independently associated with CKD in the FDRs of CKD patients<sup>30</sup>. Similarly, Egbi *et al* found that eGFR was negatively correlated with age, body mass index (BMI) and blood pressure (systolic and diastolic blood pressure) among adults in an agrarian Southern Nigerian community<sup>31</sup>.

### Independent predictors of CKD in the FDRs of the CKD probands

This study found that age, hypertension and heavy alcohol consumption were independent predictors of CKD in the FDRs, after logistic regression. This finding was similar to those of Wei *et al* and Tsai *et al* that reported that hypertension and older age were independent significant risk factors for CKD among the FDRs of CKD patients<sup>10,32</sup>. It is well known that eGFR decreases with ageing, therefore elderly people should be targeted for CKD screening and intervention. Okwuonu *et al* noted that old age, hypertension, family history of kidney disease, global obesity and central obesity were predictors of CKD among adults from the general population<sup>33</sup>.

A study reported that cigarette smoking was an independent risk factor for the development and progression of CKD<sup>34</sup>. It was also a predictor of raised urine-albumin excretion rate in diabetics and

hypertensives<sup>7</sup>. Similarly, hyperuricaemia was found to be an independent predictor of CKD development in non-CKD individuals<sup>35</sup>.

Similar to our findings, Tsai et al equally found that age and hypertension were significant independent association of CKD in relatives of haemodialysis (HD) patients<sup>32</sup>. Finally, Bagchi et al also found that older age, female sex, proteinuria and uncontrolled blood pressure had significant association with eGFR < 60 ml/min/1.73m<sup>2</sup>(<sup>36</sup>).

## CONCLUSION

Age, hypertension, significant cigarette smoking, heavy alcohol consumption, dyslipidaemia, hypercholesterolemia and hyperuricaemia were all significantly associated with CKD in the FDRs of the CKD subjects while age, hypertension and heavy alcohol consumption were independent predictors of CKD in FDRs of CKD patients.

## LIMITATIONS OF STUDY

The study was a hospital based and was carried out in Nnewi, a semi-urban city in South-Eastern Nigeria and so the findings may not be generalized to what may obtain in the rural communities.

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## RECOMMENDATIONS

Community-based studies on the associations CKD and its of risk factors in FDRs of CKD patients are needed locally.

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## CONTRIBUTION OF THE RESEARCH TO KNOWLEDGE

This study has added to the current literature on the risk factors for CKD in FDRs of CKD patients in Nigeria and would stimulate further local studies on this important topic.

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## REFERENCES

1. Definition and classification of CKD. *Kidney Int Suppl* (2011). 2013 Jan; 3(1): 19 – 62. Published Online 2012 Dec 28. Doi: 10.1038/kisup.2012.64.
2. Vivekanand P, Dm J, Garcia-garcia PG, Iseki PK, Li Z, Naicker PS, et al. Chronic kidney disease : Global dimension and perspectives. *Lancet*. 2013;382(9888):260–72.

3. Kazancioğlu R. Risk factors for chronic kidney disease: An update. *Kidney Int Suppl.* 2013;3(4):368–71.
4. Satko SG, Sedor JR, Iyengar SK, Freedman BI. Familial clustering of chronic kidney disease. *Semin Dial.* 2007;20(3):229–36.
5. Temgoua MN, Ashuntantang G, Essi MJ, Tochie JN, Oumarou M, Abongwa AF, et al. Prevalence and Risk Factors for Chronic Kidney Disease in Family Relatives of a Cameroonian Population of Hemodialysis Patients: A CrossSectional Study. *Hosp Pract Res.* 2019;4(1):12–7.
6. Schaeffner ES, Kurth T, De Jong PE, Glynn RJ, Buring JE, Gaziano JM. Alcohol consumption and the risk of renal dysfunction in apparently healthy men. *Arch Intern Med.* 2005;165(9):1048–53.
7. Bowe B, Xie Y, Xian H, Balasubramanian S, Al-Aly Z. Low levels of high-density lipoprotein cholesterol increase the risk of incident kidney disease and its progression. *Kidney Int.* 2016;89(4):886–96.
8. Rhee CM, Ahmadi SF, Kalantar-Zadeh K. The dual roles of obesity in chronic kidney disease: A review of the current literature. *Curr Opin Nephrol Hypertens.* 2016;25(3):208–16.
9. Bagchi S, Agarwal SK, Gupta S. Targeted screening of adult first-degree relatives for chronic kidney disease and its risk factors. *Nephron - Clin Pract.* 2010;116(2):128-136.
10. 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.* 2012;17(2):123–30.
11. Eleftheriadis T, Golfinopoulos S, Pissas G, Stefanidis I. Asymptomatic hyperuricemia and chronic kidney disease: Narrative review of a treatment controversial. *J Adv Res.* 2017;8(5):555–60.
12. Hallan SI, Orth SR. Smoking is a risk factor in the progression to kidney failure. *Kidney Int.* 2011;516–23.
13. Slot C. Plasma creatinine determination a new and specific jaffe reaction method. *Scand J Clin Lab Invest.* 1965;17(4):381–7.
14. Kageyama N. A direct colorimetric determination of uric acid in serum and urine with uricase - catalase system. *Clinica chimica acta.* 1956;178(4546):1325

15. Trinder P. Determination of Glucose in Blood using Glucose Oxidase with an alternative oxygen acceptor. *Ann Clin Biochem.* 1969;6:24–7.
16. KDIGO 2012 Clinical practice guidelines for the evaluation and management of CKD. *Kidney Int Suppl.* 2013;3(1):5–14.
17. Levey AS, Stevens LA, Frcp C, Schmid CH, Zhang YL, Iii AFC, et al. A New Equation to Estimate Glomerular Filtration Rate. *Ann Intern Med.* 2009;150(9):604–12.
18. Executive Summary of the Third Report of the National Cholesterol Education Program. Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *J Am Med Assoc.* 2001;285(19):2486–9.
19. 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;4:1–9.
20. World Health Organization. Definition, Diagnosis and Classification of Diabetes Mellitus and its complications. WHO, Geneva, Switzerland, 1999.
21. Afolabi MO, Abioye-Kuteyi EA, Arogundade FA, Bello IS. Prevalence of chronic kidney disease in a Nigerian family practice population. *South African Fam Pract.* 2009;51(2):132–7.
22. Koning SH, Gansevoort RT, Mukamal KJ, Rimm EB, Bakker SJL, Joosten MM. Alcohol consumption is inversely associated with the risk of developing chronic kidney disease. *Kidney Int.* 2015;87(5):1009–16.
23. Agaba EI, Agaba PA, Wigwe CM. Use and abuse of analgesics in Nigeria: a community survey. *Nigerian Journal of Medicine.* 2004; 13: 379–82.
24. Nishida C, Ko G, Kumanyika S. Body fat distribution and non communicable diseases in populations: Overview of the 2008 WHO Expert Consultation on Waist Circumference and Waist - Hip Ratio. *European Journal of Clinical Nutrition.* 2009:139.
25. WHO. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Heal Organ - Tech Rep Ser.* 2000;894.
26. Chobanian A V, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The JNC 7 Report. *J Am Med Assoc.* 2003;289(19):2560–72.
27. Wattendorf DJ, Hadley DW. Family History: The Three-Generation Pedigree. *American*

Family Physician. 2005;72(3):441-448

28. Shankar A, Klein R, Klein BEK. Original Contribution The Association among Smoking , Heavy Drinking , and Chronic Kidney Disease. *Am J Epidemiol.* 2006;164(3):263–71.
29. Sertsu A, Worku T, Fekadu G, Tura AK. Prevalence of chronic kidney disease and associated factors among patients visiting St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia: A cross sectional study design. *SAGE Open Medicine.* 2022; 10. Doi: 10.1177/20503121221116942
30. Li PKT, Ng JK, Cheng YL, Kwan TH, Leung CB, Lau M et al. Relatives in silent kidney disease screening (RISKS) Study: A Chinese cohort study. *Nephrology;* 22 (54): 35 – 42.
31. Egbi OG, Ahmed SD. Prevalence of Traditional Risk Factors of chronic kidney disease in An Agrarian Community in Edo State, Nigeria: Report of a Health Survey Survey. *Tropical Journal of Nephrology.* 2020; 15 (1): 33 – 42.
32. Tsai JC, Chen SC, Hwang SJ, Chang JM, Lin MY, Chen HC. Prevalence and Risk factors of CKD in Spouses and Relatives of Hemodialysis Patients. *Am J Kidney Dis.* 2010 May; 55 (5): 856 – 66. Doi:10.1053/j.ajkd.2009.12.021.
33. Okwuonu CG, Chukwunonye IJ, Adejumo OA, Agaba EI, Ojogwu LI. Prevalence of Chronic Kidney Disease and its Risk Factors among Adults in a Semi-urban Community of South-Eastern Nigeria. *Niger Post grad Med J.* 2017; 24: 81 – 7.
34. Aljabri K. Serum lipid profiles in patients with chronic kidney disease in a Saudi population. *Endocrinol Int J.* 2019;7(1):41–6.
35. Li L, Yang C, Zhao Y, Zeng X, Liu F, Fu P. Is hyperuricemia an independent risk factor for new-onset chronic kidney disease?: A systematic review and meta-analysis based on observational cohort studies. *BMC Nephrol.* 2014;15:122.
36. Bagchi S, Agarwal SK, Gupta S. Targeted screening of Adult First Degree Relatives for Chronic Kidney Disease and its Risk factors. *Nephron Clinical Practice (2010);* 116 (2): c128 – 136. Doi.org//0.1159/000314662.