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Research Article

A Community Study of the Risk Factors and Perceived Susceptibility to Kidney Disease Risk in Lagos State, Southwest Nigeria

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ABSTRACT

Kidney disease (KD) is one of the major public health threats with rising incidence and prevalence rates. Knowledge and perceived risk increase the perception of being susceptible, leading to the adoption of behavioural modifications. The objective was to evaluate the knowledge of KD risk factors and perceived susceptibility as well as predictors of KD risk in Lagos State, Nigeria. This was a cross-sectional study conducted in Lagos State, Southwestern Nigeria. A pretested structured questionnaire was used to draw information from 1171 male and female residents aged ≥ 18 years on socio-demography, knowledge and perceived susceptibility to KD risk. Percentages, frequencies, Chi-square, binary and multinomial logistic regression models were used, with a significance of $p<0.05$. A total of 1,061 participants, with a mean age of 33.8±11.5 years and male-female ratio of 1.2:1, completed the instrument. Only 78.6% had good knowledge of KD risk factors, while 63.0% had perceived low susceptibility to KD risk. The common self-reported risk factors were high salt intake (91.28%) and herbal concoction (82.21%). High blood pressure (17.51%), high blood sugar (17.96%) and family history of KD (7.92%) were also self-reported. The independent predictors of KD risk were herbal concoction [Odds ratio (OR) =3.43, Confidence Interval (CI) =1.88–6.27] and frequent use of pain killers [OR=2.06, CI=1.24–3.39]. Knowledge of KD risk factors was quite high but perceived susceptibility to KD risk was low. There is a need for continuous sensitization, educational health interventions and screening for early detection.

Keywords: *kidney diseases, knowledge, perceived susceptibility, risk factors*

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INTRODUCTION

Kidney disease (KD) either acute or chronic remains one of the progressive disease groups with high mortality, posing a massive burden on affected victims, their families and on the nation's health finances, especially in developing countries. Thus, the burden appears to be more evident among elderly and economically active population regardless of their sex. Those at a higher risk of developing KD do not go early for screening and diagnosis, making them particularly more vulnerable to KD morbidity and mortality (Oluyombo *et al*., 2016; Rosenthal-Asher *et al*., 2016). Proactive interference and explanation of KD symptoms that are not immediately obvious and are subjected to many medical interpretations, has led more KD victims to receive treatment for other health problems, thereby causing late presentation of their KD ailments. Several studies have indicated that there are specific barriers to KD diagnosis and screening, which include knowledge of KD risk factors, the level of susceptibility and perceived risk of KD being a complicated as well as a terminal disease (Boulware *et al*., 2009; Akokuwebe, 2017; Akokuwebe *et al*., 2019; 2020).

Studies in developed countries' such as in the United States of America (USA) stated that there are about 26 million American adults reporting chronic kidney disease (CKD) and millions more are still at high risk. Thus, various socio-cultural factors have been indicated to may exert effect on the persisting inequalities towards KD among African American community (Waterman *et al*., 2008). While another study conducted by Bruce *et al*. (2009) described in summary the various pathways through which economic, social environmental stressors, including psychological factors can impact KD and its progression among African Americans. A different study (Migliore *et al*., 2016) stated that economic deprivation, social disparities and social stressors (such as racism and discrimination) faced by African Americans can impact KD development and its progression. Calvin *et al*. (2011) reported that sub-optimal healthcare, sub-optimal ecological settings, and unhealthy lifestyles accounting for 50% of the further risk for KD among African Americans when compared to the Whites folks (Calvin *et al*., 2011).

Other existing studies from developed countries have conveyed that one out of eight adult Americans divulge proof of having KD ailments (Waterman *et al*., 2008; Calvin *et al*., 2011; Migliore *et al*., 2016) and comparable estimates have been cited in studies piloted across Asian countries (Imai *et al*., 2009; Anupama *et al*., 2014; Anand *et al*., 2014; Imran *et al*., 2015; Hasan *et al*., 2018). On the other hand, such data are scanty in Africa, including in Nigeria, owing to paucity of the national government registries of KD and limited surveys. Although, health demographic surveys, epidemiological and community-based studies in Nigeria have reported incidence rates of CKD ranging between 1.6% and 12.4% (Iyalomhe and Iyalomhe, 2010; Odubanjo *et al*., 2011; Oluyombo *et al*., 2016; Akokuwebe, 2017; Akokuwebe *et al*., 2019) and prevalence rates of 11.4−18.8% (Afolabi *et al*., 2009; Ulasi *et al*., 2013; Akpan and Ekrikpo, 2015; Akokuwebe, 2017; Akokuwebe *et al*., 2019; Akokuwebe *et al*., 2020). Although, several studies conducted within the regions of Nigeria to enumerate the magnitude of KD burden and its primary risk factors among her citizens, have come up with an unpredictable outcomes, as most of these studies' findings were hospital-based. Thus, the representation of chronicity was based on duration of usual predisposing signs and symptoms towards KD advanced stages (Adetuyibi *et al*., 1976; Mabayoje *et al*., 1992; Odubanjo *et al*., 2011; Oluyombo *et al*., 2016). These hospital-based studies have failed to include persons who did not report their KD ailments at health facilities or do have access to healthcare services owing to no health insurance cover (Oluyombo *et al*., 2016; Akokuwebe and Erhabor, 2022). Likewise, there are other underlying factors contributing to KD burden in Nigeria such as poor literacy level, inadequate knowledge of risk factors, dearth of KD prevention programmes, poor access to healthcare, late presentation, limited kidney organ replacement therapy and its unaffordability, as well as harmful lifestyles practices (Ulasi and Ijoma, 2010; Oluyombo *et al*., 2016; Bisi-Onyemaechi *et al*., 2018).

In Nigeria, the government and relevant health stakeholders have made several and significant efforts to create KD awareness and preventive interventions, yet the growing prevalence and incidence rates are a public concern. Factors such as the populace's attitude towards KD risk factors, poor knowledge of KD and perceived susceptibility to KD as well as medical diagnosis of other chronic ailments such as diabetes, hypertension and family history of KD, need to be examined extensively so that health workers' involvements in prevention programmes becomes more effective, especially among 'high risk' population and in rural grassroots' communities (Bamgboye, 2015; Roomizadeh *et al*., 2014, Okwuonu *et al*., 2017). Notably, it is important to explore Nigerian populations, with poor knowledge and awareness of the disease risk factors as well as their poor perception risk and their involvement in unhealthy behavioural practices that are detriment to the kidney organ and human health.

Furthermore, knowledge of KD risk factors and perception of disease risk is an important determinant of health-related behaviours, as the risk of KD is often overlooked, and its severity of its consequences are under-recognized. The perception risk for KD development or its progression are poorly characterized and factors influencing individuals' perceived KD risk have been under-studied (Nwankwo *et al*., 2005; Afolabi *et al*., 2009; Odubanjo *et al*., 2011; Okwuonu *et al*., 2017). Emphasis on KD risk factors awareness is more likely to improve health behaviour, by increasing risk perception that will stimulate individuals to opt for early screening and diagnosis. Thus, the aim of the study was to determine the knowledge of risk factors and perceived susceptibility to KD risk in Lagos State, South West Nigeria. Hence, this study adds to the body of knowledge in this core areas of health demography and population wellness.

MATERIALS AND METHODS

Selection and Description of Participants: This was a cross-sectional study conducted in six urban (Lagos Island, Lagos Mainland, Ajeromi-Ifelodun, Somolu, Kosofe and Agege) local government areas (LGAs) in Lagos State, South-western Nigeria. This setting was selected because it featured prominently as one of the kidney-prone states in 2015 (Bamgboye, 2015). Male and female adults who were 18 years or older constituted the study population. A previous community-based study by Amira *et al*. obtained a CKD prevalence of 23.9% (Amira *et al*., 2017). The sample size of this study was extrapolated from 95% confidence and 5% error margin, using the appropriate formula for study population greater than 10,000 (Binu *et al*., 2014), giving 1171 participants.

This number was increased to 1,200 to make allowance for 10% possible non-responders and increase the scope of the study. A multistage systematic sampling technique was used and one in every ten participants was enrolled for the study, with the sampling interval of approximately 1:10. Forty-five enumeration areas (EAs) (representing 60% of the total EAs) in the six LGAs were selected randomly by balloting and houses where every 10th participant was residing were given single numbers for location (Gaziano, 2011). Where the selected EAs were not adjacent, the first house in the next EA was regarded as an extension of the preceding EA. Participants who were <18 years and those who did not give informed consent were excluded from the study. Furthermore, non-permanent Nigerians resident of Lagos State were excluded.
The questionnaire was adapted from National Kidney Disease Education Programme (NKDEP), World Health Organization Comparative Risk Assessment and KD Risk Prediction recommended STEPS approach to chronic disease surveillance, with some modifications (Hostetter *et al*., 2003; Lerner *et al*., 2017). Also, a number of previous knowledge surveys on KD risk factors were used (Iyalomhe *et al*., 2010; Ulasi *et al*., 2013; Oluyombo *et al*., 2016). A pre-tested semi-structured questionnaire was administered to each participant by a trained research assistant. Demographic information (educational status, age, occupation, employment status and income status and religion) were obtained and participants with known self-reported medical history of other chronic illnesses were included in the study as well as those with self-reported family history of KD with clinical proof of their medical histories. Risk-inducing lifestyles were self-reported

(Oluyombo *et al*., 2016; Akokuwebe, 2017; Akokuwebe *et al*., 2019; Akokuwebe *et al*., 2020).

The knowledge part of the questionnaire on KD risk factors had 30 multiple-choice questions. With a score of 0–59, a binary variable was created with a mean score of 28.37, where knowledge scores of 0–28 was coded '0' (low knowledge) and scores of 29–59 were coded '1' (high knowledge) (Akokuwebe *et al*., 2019; Akokuwebe *et al*., 2020). The perceived KD risk section of the questionnaire had 20 multiple-choice questions, which were generated from self-reported risk-inducing lifestyles and bio-medical risk factors using the WHO Comparative Risk Assessment and KD Risk Prediction Models (Lerner *et al*., 2017). These risk factor profiles were combined with information on the relative risk of each risk factor, along with the population-level estimate of absolute risk. Based on KD risk prediction (Lerner *et al*., 2017; Akokuwebe *et al*., 2020; Anuar *et al*., 2020), the participants were categorized as being at perceived low susceptibility (0-29.0%), perceived intermediate susceptibility (30.0–59.0%) or perceived high susceptibility (≥60.0%).

Ethics: The study was approved by the Social Sciences and Humanities Research Ethics Committee (SSHEC) University of Ibadan (ref. no. UI/SSHEC/14/0003). It was conducted in compliance with the Helsinki Declaration and ethical consideration procedures. Informed written consent was obtained from participants where appropriate.

Statistical analysis: The data were collected and managed using Microsoft Excel sheet. The computer-based statistical package Statistical Package for the Social Sciences (SPSS) 14.0 (SPSS Corp, USA) was used for the analysis. Categorical variables were presented as percentages and frequencies to describe the sample characteristics of the respondents, knowledge of KD risk factors and perceived susceptibility to KD risk. Statistical significance in the prevalence of risk factors was tested using $\chi 2$ tests or Fisher's exact tests, where appropriate. The multinomial logistic regression model showing relative risk ratio (RRR) was used to determine the relationship between perceived susceptibility to KD risk, KD risk factors and demographic factors. A confidence interval of 95% was used, and $p<0.05$ was regarded as significant.

RESULTS

Baseline study sample and characteristics: The baseline sample consisted of 1171 participants; one hundred and ten of them who reported not having knowledge of KD were excluded from the survey. The baseline characteristics summarized by knowledge level are documented in Table 1. Therefore, 1061 participants were included in the analysis (89.6% cooperation rate), of whom 52.5% were males. The mean age of the participants was 33.8±11.5 years, and their median age was 34 years (range 18–85+). The male-female ratio was 1.2:1. With the exception of gender (p=0.076), age (p=0.195) and education (p=0.557), significant differences were observed with knowledge of KD and perceived susceptibility to KD (p=0.000). Religion, occupation and income were higher for the participants with good knowledge of KD than for those with poor knowledge ($p<0.05$)

Table 1:
Characteristics of study participants stratified by knowledge level of kidney disease (Data are expressed as number, percentage and Chi-square)

Socio-demographic factors		Knowledge levels, (N=1061)			χ^2	p-value
		Poor (n, %)	Good (n, %)	Total (n, %)		
Sex	Male (52.50%)	131 (23.52)	426 (76.48)	557 (100.0)		
	Female (47.50%)	96 (19.05)	408 (80.95)	504 (100.0)	3.1453	0.076
Age group	18–24 (41.41%)	74 (18.83)	319 (81.17)	393 (100.0)		
	25–34 (24.03%)	54 (23.68)	174 (76.32)	228 (100.0)	3.2689	0.195
	>35 (34.56%)	78 (23.78)	250 (76.22)	328 (100.0)		
Education	Non-educated (13.42%)	33 (23.24)	109 (76.76)	142 (100.0)	0.3445	0.557
	Educated (86.58%)	193 (21.07)	723 (78.93)	916 (100.0)		
Marital status	Single (60.38%)	126 (19.69)	514 (80.31)	640 (100.0)		
	Married (36.32%)	94 (24.42)	291 (75.58)	385 (100.0)	3.2363	0.198
	Previously married (3.30%)	7 (20.00)	28 (80.00)	35 (100.0)		
Ethnic group	Yoruba (57.96%)	127 (20.65)	488 (79.35)	615 (100.0)		
	Igbo (26.48%)	71 (25.27)	210 (74.73)	281 (100.0)	5.5156	0.138
	Hausa (4.15%)	5 (11.36)	39 (88.64)	44 (100.0)		
	Others (11.40%)	24 (19.83)	97 (80.17)	121 (100.0)		
Religion	Christianity (77.57%)	192 (23.33)	631 (76.67)	823 (100.0)		
	Islam (21.96%)	35 (15.02)	198 (84.98)	233 (100.0)	8.8199	0.012*
	Traditionalist (0.47%)	0 (0.00)	5 (100.00)	5 (100.0)		
Occupation	Not working (23.66%)	41 (16.33)	210 (83.67)	251 (100.0)	5.0060	0.025*
	Working (76.34%)	186 (22.96)	624 (77.04)	810 (100.0)		
Income	Low (33.96%)	60 (16.67)	300 (83.33)	360 (100.0)		
	High (66.04%)	167 (23.86)	533 (76.14)	700 (100.0)	7.3038	0.007*
Perceived susceptibility	Low (62.96%)	38 (5.69)	630 (94.31)	668 (100.0)		
	Moderate (16.21%)	34 (19.77)	138 (80.23)	172 (100.0)	410.4452	0.000*
	High (20.83%)	155 (70.14)	66 (29.86)	221 (100.0)		

Knowledge of KD risk factors: Pertaining to knowledge of KD risk factors, the knowledge level of KD risk factors was good in 78.6% of the respondents as compared to poor knowledge of kidney disease (21.4%), as shown in Figure 1.

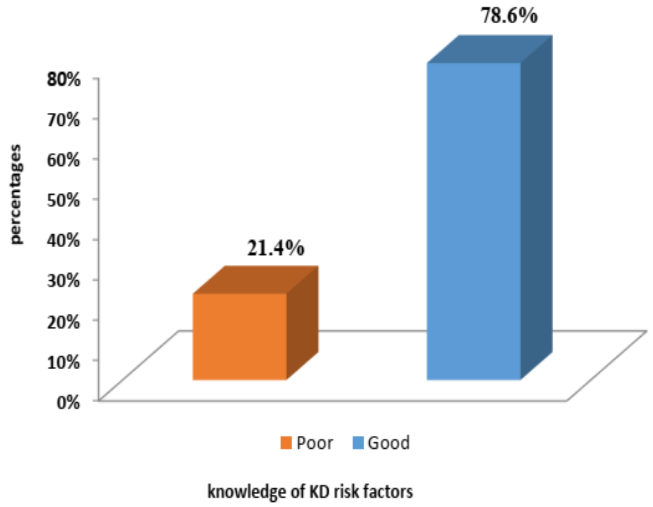

Figure 1:
Distribution of knowledge of kidney disease risk factors among study participants

Prevalence of risk factors: Kidney disease (KD) risk factors are shown for the total population, and stratified by their multiple responses (Yes or No) (Table 2). Of the total population, 93.0% (507/589) reported being engaged in chronic alcohol intake, while 91.3% reported high salt intake. About 82.2% reported having herbal drink and 88.0% mentioned being engaged in excessive cigarette smoking. For self-reported medical history, only 18.0% had diabetes, while 17.5% had high blood pressure, and 12.5% were obese. Similarly, 7.9% reported a family history of kidney disease among first-degree relatives (Table 2).

Incidence of risk factors for participants with KD risk as "higher than average": The main predictors of risk-inducing lifestyles for participants with KD risk "higher than average" were high salt intake (Odds Ratio (OR) =2.95, Confidence Interval (CI) =1.47–5.92), cigarette smoking (OR=1.37, CI=0.55–3.43), traditional herbal drink (OR=2.38, CI=1.24–4.56) and frequent use of pain killers (OR=4.81, CI=2.64–8.77), as shown in Table 3. Also, self-reported history of obesity (OR=1.23, CI=0.45–3.38), high blood sugar (OR=4.75, CI=2.66–8.49), family history of KD (OR=1.40, CI=0.69–2.84) and high blood pressure (OR=2.15, CI=1.33–3.74) were documented in Table 3.

Calculated perceived risk of kidney problem: The perceived susceptibility of suffering a KD associated with self-reported risk-inducing and biomedical factors, according to World Health Organization Comparative Risk Assessment (WHOCRA) and KD Risk Prediction Models (KDRPM), is shown in Fig. 2. Based on the models, 63.0% of the participants reported perceived low susceptibility, 16.2% stated perceived intermediate susceptibility and 20.8% were at perceived high susceptibility to KD risk. Of these, only 221 participants were categorized as being at high risk of KD based on combined multiple risk factors alone. Also, 172 participants were categorized as being at perceived intermediate susceptibility either because of in-between established self-reported risk-inducing lifestyles or levels of individual risk factors. The WHOCRA and KDRPM identified more participants as being at perceived low susceptibility (63.0%, $p<0.05$) probably because of low recognition of the association with combined multiple risk factors to KD.

Table 2:
Determination of the prevalence of risk factors among the study participants (univariate analysis)

Risk factors	**Prevalence of risk factors, (N=1061)**				
Risk-inducing lifestyles	**Yes (n=589), n (%)**	**No (n=472), n (%)**	**OR**	**95% CI**	**p-value**
Sedentary lifestyle	235 (49.80)	237 (50.20)	1.11	0.71-1.73	0.452
Unhealthy diet	397 (79.56)	102 (20.44)	1.23	0.79-1.92	0.050*
High salt intake	450 (91.28)	43 (8.72)	2.45	1.52-3.94	0.000*
Chronic alcohol intake	507 (93.00)	38 (7.0)	0.84	0.43-1.65	0.632
Excessive cigarette smoking	470 (88.0)	64 (12.0)	1.25	0.67-2.34	0.659
Medicine without prescription	424 (82.70)	89 (17.30)	0.80	0.49-1.30	0.002*
Physical inactivity	263 (55.02)	215 (44.98)	0.97	0.61-1.54	0.040*
Traditional herbal drink	402 (82.21)	87 (17.79)	3.53	2.09-5.96	0.000*
Frequent use of pain killers	317 (66.18)	162 (33.82)	1.79	1.15-2.78	0.000*
Self-reported medical history					
Obesity	60 (12.45)	422 (87.55)	1.19	0.74-1.91	0.006*
Cardiovascular disease	46 (9.52)	437 (90.48)	1.42	0.82-2.47	0.400
High blood sugar (Diabetes mellitus)	88 (17.96)	402 (82.04)	0.85	0.52-1.39	0.000*
High cholesterol	41 (8.42)	446 (91.59)	1.43	0.85-2.43	0.050*
Family history of kidney disease	41 (7.92)	477 (92.08)	0.72	0.41-1.26	0.000*
Liver disease	1 (0.20)	493 (99.80)	7.47	0.00-0.00	0.596
High blood pressure (hypertension)	87 (17.51)	410 (82.49)	0.37	0.23-0.59	0.000*

Table 3:
Binary logistics regression analysis of risk factors among the study participants with KD risk as "higher than average" (univariate analysis)

Risk factors	**Affirmative responses (N=589)**				
Risk-inducing lifestyles	**n**	**%**	**OR**	**95% CI**	**p-value**
Sedentary lifestyle	235	39.90	0.69	0.03 – 0.15	0.08
Unhealthy diet	397	67.75	0.88	0.49 – 1.56	0.12
High salt intake	450	76.40	2.95	1.47 – 5.92*	0.00
Chronic alcohol intake	507	86.08	0.19	0.67 – 0.54	0.10
Excessive cigarette smoking	470	79.80	1.37	0.55 – 3.43	0.38
Medicine without prescription	424	72.00	0.26	0.09 – 0.75	0.20
Physical inactivity	263	44.65	0.28	0.13 – 0.59*	0.00
Traditional herbal drink	402	68.25	2.38	1.24 – 4.56*	0.00
Frequent use of pain killers	317	53.82	4.81	2.64 – 8.77*	0.02
Self-reported medical history					
Obesity	60	10.19	1.23	0.45 – 3.38*	0.01
Cardiovascular disease	46	7.81	0.32	0.09 – 1.08	0.06
High blood sugar (Diabetes mellitus)	88	14.94	4.75	2.66 – 8.49*	0.00
High cholesterol	41	6.96	0.33	0.09 – 1.14*	0.05
Family history of kidney disease	41	6.96	1.40	0.69 – 2.84*	0.02
Liver disease	1	0.17	0.00	0.00 – 0.00	0.06
High blood pressure (hypertension)	87	14.77	2.15	1.33 – 3.74*	0.00

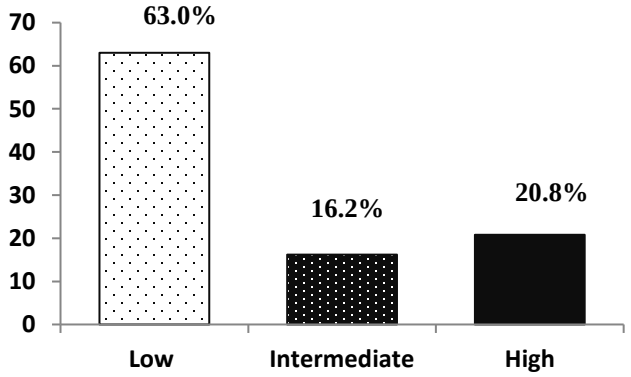

Figure 2:
The perceived susceptibility of KD risk as a result of the presence of risk factors

Factors predicting perceived KD risk: Table 4 indicates the multinomial logistic regression analysis of adjusted independent predictors of perceived susceptibility to KD risk. The respondents with perceived intermediate susceptibility with high salt intake were found to be 25% higher, predicting high KD risk [Relative Risk Reduction (RRR): 2.53, CI = 1.44–4.44, p<0.05], than those with perceived high susceptibility to KD risk. The respondents with perceived high susceptibility with physical inactivity were found to be 33% higher, predicting high KD risk [RRR: 3.32, CI = 1.68–6.57, p<0.05], than those with perceived intermediate susceptibility to KD risk. The respondents with perceived intermediate susceptibility who consumed traditional herbal drink were found to be 34% higher, predicting increased KD risk [RRR: 3.43, CI = 1.88–6.27, p<0.05], than those with perceived high susceptibility to KD risk (Table 4).

Similarly, those who had history of obesity risk factors, with perceived intermediate susceptibility, were found to have 13% higher increased KD risk than those with high susceptibility (2.0%). Those with raised hypertension had perceived intermediate [RRR: 0.67 CI = 0.38–1.17, p>0.05] or high susceptibility [RRR: 0.20, CI = 0.08–0.49, p<0.05] predicted decreased perceived susceptibility to KD risk, compared to those with perceived low susceptibility. The respondents having high blood sugar and high cholesterol with perceived intermediate susceptibility were found to have increased susceptibility to KD risk compared to their counterparts with perceived high susceptibility (Table 4).

DISCUSSION

This study assessed the knowledge and perceived susceptibility of Nigerians resident in Lagos State regarding KD and its two main risk factors, namely lifestyle and biomedical factors. Based on the findings, the overall knowledge of KD risk factors was quite high (78.6%). This suggests that many Nigerian residents of Lagos State are adequately informed of the subject of the significant role of risk factors in the development of KD. Only 21.4% of the participants did not believe that KD development is as a result of its associated risk factors and did not see it as a growing medical problem. This finding is consistent with the finding of a study by Chow *et al* (2012), in which 51.3% of the respondents could correctly identify the risk factors for KD risk. Findings from Nigerian studies (Odubanjo *et al*., 2011; Okaka *et al*., 2012; Okwuonu *et al*., 2017) have consistently showed poor knowledge of KD risk factors and ignorance of the causes of KD among the general population. This becomes very important because there are certain factors that increase the chances of getting KD, but do not necessarily cause the disease. As the causes of KD are multilevel, accumulation of risk factors over the years is embedded in dynamic interpersonal relationships.

Table 4:
Multinomial logistic regression analysis of factors associated with participants' perceived kidney disease risk

Perceived Low susceptibility (base outcome)	Intermediate			High		
Risk factors	**RRR**	**CI**	**p value**	**RRR**	**CI**	**p value**
Sex						
Female	0.99	0.64 – 1.55	0.99	0.85	0.51 – 1.43	0.54
Age						
25 – 34	0.63	0.36 – 1.13	0.12	1.51	0.79 – 2.88	0.207
>35	0.71	0.43 – 1.16	0.17	1.19	0.66 – 2.16	0.56
Educational status						
Educated	1.80	0.91 – 3.58	0.09	1.49	0.69 – 3.24	0.30
Occupational status						
Working	1.37	0.81 – 2.32	0.24	1.07	0.56 – 1.99	0.84
Income level						
High income	0.95	0.59 – 1.52	0.84	1.18	0.69 – 2.04	0.54
Sedentary lifestyle						
Yes	1.08	0.66 – 1.78	0.76	2.24	1.27 – 3.97*	0.01
Unhealthy diet						
Yes	1.05	0.64 – 1.71	0.86	0.83	0.43 – 1.61	0.58
High salt intake						
Yes	2.53	1.44 – 4.44*	0.00	1.84	0.82 – 4.14	0.14
Chronic alcohol intake						
Yes	0.85	0.39 – 1.81	0.67	0.78	0.25 – 2.45	0.67
Excessive cigarette smoking						
Yes	0.76	0.36 – 1.60	0.47	0.78	0.25 – 2.45	0.69
Medicine without prescription						
Yes	0.77	0.45 – 1.31	0.33	1.01	0.46 – 2.22	0.97
Physical inactivity						
Yes	1.09	0.65 – 1.85	0.72	3.32	1.68 – 6.57*	0.00
Traditional herbal drink						
Yes	3.43	1.88 – 6.27*	0.00	2.48	1.19 – 5.14*	0.02
Frequent use of pain killers						
Yes	2.06	1.24 – 3.39*	0.01	4.31	2.16 – 8.59*	0.00
Obesity						
Yes	1.31	0.77 – 2.22	0.32	0.18	0.05 – 0.58*	0.00
Cardiovascular disease						
Yes	0.99	0.51 – 1.94	0.98	0.28	0.56 – 1.37	0.12
High blood sugar (Diabetes mellitus)						
Yes	1.39	0.77 – 2.54	0.27	0.42	0.14 – 1.21	0.11
High cholesterol						
Yes	1.40	0.73 – 2.67	0.31	0.31	0.06 – 1.56	0.15
Family history of KD						
Yes	0.72	0.36 – 1.42	0.34	0.65	0.20 – 2.08*	0.47
High blood pressure (hypertension)						
Yes	0.67	0.38 – 1.17	0.16	0.20	0.08 – 0.49*	0.00

There have been few community-based studies on knowledge of KD risk factors among the general populace of Lagos State, with most published research focusing on the medical screening of high-risk populations or hospital-based patients. Oluyombo *et al*. (2016) reported poor knowledge and awareness of risk factors of CKD in a hospital facility in rural community of Ilie, Olorunda Local Government Area of Osun State, Nigeria. Similarly, Bisi-Onyemaechi *et al*. (2018) reported an overall poor knowledge of symptoms attributable to KDs among respondents in a health facility, which is similar to what has been reported in previous studies (Iyalomhe *et al*., 2010; Akpan *et al*., 2015). This baseline knowledge of KD risk factors may serve as a solid foundation upon which to educate people further, especially in the context of favourable attitudes toward learning more about kidney disease. Improving health outcomes for KD risk factors through targeted educational interventions in high-risk populations may be integral for improving non-communicable disease (NCD) outcomes more broadly. However, such KD health programmes will need to be sensitive to healthcare information that will include both risk-inducing lifestyles and biomedical factors.

Risk factors characterized by risk-inducing lifestyles and biomedical factors were identified. The findings on the prevalence of KD risk factors among the participants showed a clear relationship between numerous risk factors and KD risk. Risk-inducing lifestyles, including unhealthy diet, high salt intake, traditional herbal drink, and frequent use of pain killers, were commonly reported by the study participants. The major biomedical factors that were self-reported by the participants were high blood pressure, high blood sugar, high cholesterol and family history of kidney disease. The findings on prevalence of KD risk factors among Nigerian residents of Lagos State are comparable to previous studies in developed countries (Chow *et al*., 2012; Shisana *et al*., 2013; Oluyombo *et al*., 2016; Akokuwebe, 2017; Bisi-Onyemaechi *et al*., 2018; Akokuwebe *et al*., 2019; Akokuwebe *et al*., 2020). In this

study, the participants with KD risk "higher than average" were found to have risk factors such as high salt intake, traditional herbal drink, frequent use of pain killers, high blood sugar and high blood pressure. This finding confirms other studies (Ulasi *et al*., 2010; Ulasi *et al*., 2013; Oluyombo *et al*., 2016; Akokuwebe, 2017; Bisi-Onyemaechi *et al*., 2018; Akokuwebe *et al*., 2019; Akokuwebe *et al*., 2020) which noted that persons with KD high risk were likely to have inadequate knowledge about KD risk factors, inaccurate risk perceptions, and low concern for KD. Other studies (Ulasi *et al*., 2010; Oluyombo *et al*., 2016; Bisi-Onyemaechi *et al*., 2018; Akokuwebe *et al*., 2020) cited socio-cultural factors inhibiting KD awareness and risk perceptions towards KD development or progression.

In spite of awareness and knowledge of KD, denial of KD and its risk factors as well as non-adherence among those with medical history of other chronic ailments are the possible psychosocial challenges which could lead to KD and, eventually, poor health outcomes (Boulware *et al*., 2009). This is worse among the participants who had KD with combined risk factors, such as raised hypertension, raised blood sugar and family history of KD, owning to the fact that these risk factors are major markers of CKD development or progression (Odubanjo *et al*., 2011; Okwuonu *et al*., 2017; Bisi-Onyemaechi *et al*., 2018; Akokuwebe *et al*., 2020).

Perceived low susceptibility to KD risk (63.0%) was found among the study subjects despite high knowledge of KD risk factors. This is similar to reports from hospital-based facilities in developed countries, where KD-diagnosed patents' perceived susceptibility was found to be 60%–63% (Boulware *et al*., 2009; Roomizadeh *et al*., 2014). The findings of this study on perceived low susceptibility could be linked to relative low recognition of KD, which might not be unrelated with the traditional "non-feasibility" of the kidney organ in the high ranking vital organs of the body. Adequate and correct information as well as health education on KD should be tailored towards reducing KD risk factors by lifestyle modification and seeking appropriate medical attention when faced with ailments resulting from non-modifiable risk factors. Knowledge of KD and risk factors increases the perception of being at high risk and increasing prevention of the disease. Few studies have reported poverty and ignorance as cause of low perceptions of KD risk (Afolabi *et al*., 2009; Boulware *et al*., 2009; Akokuwebe *et al*., 2019). Efforts on prevention health programmes will improve the overall population health on KD risk factors and KD risk.

The main independent predictors of KD risk were education, working, high salt intake, traditional herbal drink, frequent use of pain killers, raised blood sugar and raised cholesterol. Similar findings were noted in earlier studies (Afolabi *et al*., 2009; Bamgboye, 2015). A study in urban Uyo, South south region of Nigeria had a similar result (Akpan *et al*., 2015) and Su *et al*. (2011) reported regular use of nephrotoxic medication as an independent risk factor for CKD among Chinese population. Herbal drink and raised blood sugar remain an independent risk factor for KD development. For instance, acute kidney injury has been associated with consumption of herbal concoctions (Roomizadeh *et al*., 2014). Also, raised hypertension has been associated with KD development/progression owing to the "silent nature" of its manifestation and under-recognition of its unintended consequences on kidney organ (Katibi *et al*., 2010; Iyalomhe *et al*., 2010).

Effort should be made to screen individuals for KD and other medical factors and the results should be comprehensively interpreted to allow an informed decision. The effect of avoiding the risk factors of KD development and its progression to chronic kidney disease/end-stage renal disease should be stressed, as most people could not afford the cost of dialysis and renal replacement therapy. High mortality from kidney failure is as a result of the inability to sustain or procure kidney therapy and treatment. Emphasis should, therefore, be placed on health preventive interventions that will be geared toward improving the awareness of the populace and knowledge on the various risk factors and the increased tendency to develop KD as well as the treatment modalities for high-risk populations diagnosed with the disease.

This study has significant strengths. This is the first known community-based assessment of knowledge and perceived susceptibility related to KD risk factors and KD development among the general populace in Lagos State. The findings will be useful in formulating local and community-based programmes. Besides, the survey instrument was tested for construct validity, content validity, and reliability. Finally, the study, to a large extent, had a good coverage of the community where the study was carried out. This may favour generalisation of the findings in other political zones of Nigeria.

There were a few limitations to the study. As this was a cross-sectional study, participants who had prior knowledge of KD and gave consent to participate in the study were recruited for the study, presenting a potential bias in the sample. The knowledge of KD risk factors and perceived susceptibility to KD development were also self-reported; so the concern of recall bias is of importance. The study did not include medical diagnosis of the disease; those with medical history of chronic ailments self-reported. The knowledge and perceived susceptibility issues looked at were based on social matters and were measured with psychological scales. The determination of risk-inducing lifestyles and medical history of other chronic ailments did not involve the length of time for the self-reported risk factors.

In conclusion, the general knowledge level of Nigerians about KD and its risk factors is quite high but their perceived susceptibility towards KD is low. High-risk individuals with medical history of other chronic illnesses are not adequately informed regarding their increased risk for KD development. The low perceived susceptibility is connected to low recognition of the kidney organ, which is not perceived as a central organ in body metabolism. Hence, future public awareness campaign programmes should be more targeted towards communities with high prevalence of risk-inducing lifestyles and biomedical risk factors. We hope that this study will contribute to Nigeria's effort in putting in place preventive measures to reduce KD burden. These include KD health education, especially at grassroots' level, posters on KD risk factors and information through the media in order to achieve the desirable health outcomes of Nigerians.

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