PREVALENCE OF AND FACTORS ASSOCIATED WITH CHRONIC KIDNEY DISEASE IN OSTEOARTHRITIS PATIENTS AT KENYATTA NATIONAL HOSPITAL

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ABSTRACT

Background: Chronic Kidney Disease (CKD) is a global health problem with an increase in prevalence especially in Sub-Saharan Africa (SSA). It has a high morbidity and mortality. CKD and osteoarthritis (OA) are related as they both increase with age and are associated with comorbidities e.g. hypertension, obesity etc. However, there is limited evidence on the prevalence and associated risk factors of CKD among OA patients.
Objective: To assess the prevalence and factors associated with CKD in OA patients attending Rheumatology and Orthopaedic clinics at Kenyatta National Hospital.
Design: A hospital-based descriptive cross-sectional study.
Methods: The study was conducted between November 2019 and January 2020 involving patients aged 18 years and above; being followed up in the rheumatology and orthopaedic clinics at Kenyatta National Hospital with a diagnosis of knee, hip, spine and hand osteoarthritis based on the American College of Rheumatology criteria. Chronic kidney disease was defined as an eGFR of less than or equal to 60 ml/min/1.73m^2 and/or proteinuria of 30 mg/dl detected on urinary dipstick for three months or more. Descriptive statistics were used to describe the participants. Association between participants' characteristics and CKD prevalence were assessed using chi-square and factors associated with CKD among OA patients using bivariate and multivariable logistic regressions.
Results: The overall prevalence of CKD among patients with osteoarthritis was 61.9% (56.4–66.3) as per eGFR using Cockrauft Gault (CG). Most were in CKD stage 3 at 59.2% with 45.5% in G3a and 13.7% in G3b. One point one percent were in stage 1, 38.3% in stage 2 and 1.4% were in CKD stage 4 and 5. Only 12.1% of the respondents had persistent proteinuria and thus most of the patients had low and moderate risk for CKD progression at 38% and 38.2% respectively. Only 12.1% and 11.6% had high and very high risk for CKD progression. The CKD prevalence increased with age, being highest among older adults (65+ years). The prevalence was higher among men than women (65.9%, 95% CI: 54.7–75.5 vs. 60.2%, 95% CI: 54.4–65.7). The factors associated with CKD in OA were old age, hypertension and poor and fair self-rated health which increased the odds of CKD while moderate physical activity, overweight/obesity and use of more than one medication (NSAID/ACEI/ARB) reduced the odds of CKD.
Conclusion: This study provides evidence that osteoarthritis is associated with a high prevalence of CKD. However, most of the patients are asymptomatic and in low and moderate risk category based on Kidney Disease Improving Global Outcomes (KDIGO) nomenclature. Osteoarthritis patients should be considered a high-risk group for chronic kidney disease given their older age, chronic use of NSAIDs and high prevalence of comorbidities e.g. hypertension, overweight/obesity which are known risk factors for CKD. Screening for CKD in OA patients should therefore be done routinely as is the case in other high risk groups e.g. diabetes.

Key words: Chronic Kidney Disease (CKD), Osteoarthritis (OA), Cockrauft-Gault (CG), Estimated Glomerular Filtration Rate (eGFR), Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), Angiotensin-Converting Enzyme Inhibitors (ACEI), Angiotensin Receptor Blockers (ARB)

INTRODUCTION

Chronic Kidney Disease (CKD) is a recognized global public health problem whose effects are felt across different socioeconomic divides. It directly resulted in an estimated 1.23 million deaths in 2017. It was the 12th leading cause of death globally in 2017. In addition to deaths resulting from CKD, impaired kidney function puts individuals at a higher risk for cardiovascular disease. In 2017, 1.36 million deaths were attributable to cardiovascular disease resulting from impaired kidney function (1).

Chronic Kidney Disease (CKD) and Osteoarthritis (OA) are among the top thirty largest contributors to the Years-Lived with a Disability (YLD) (2). CKD moved up four places to 24th between 1990 and 2015 and contributed to approximately 8172.8 YLDs (2). CKD is a known complication of other diseases, a comorbid condition, and a side effect of some medications with major impacts on health, healthcare

cost and productivity (3). The CKD prevalence is estimated to be 13.4% globally (4). In Sub-Saharan Africa (SSA), CKD prevalence is 15.8% for stages 1 to 5 and 4.6% for stages 3 to 5 (5). Urban populations have a higher CKD prevalence than rural populations (6). In Kenya, the prevalence of CKD is estimated at 0.41% in Kericho County (7) to a high of 10%-26% based on the global estimates of CKD (8-11).

Osteoarthritis (OA), a painful, upper and lower extremities degenerative joint disease has been on the rise globally (12,13). OA affects 30 million people in the US resulting in a prevalence of 6% and 3% for symptomatic knee and hip OA respectively (14) while Canada has an overall prevalence of OA of 14.8% (15). In India, the prevalence is estimated at between 21.6–29.7% (16,17). In Kenya, knee, hip and hand OA prevalence is 15%, 3% and 5% respectively (18). Osteoarthritis is common among the older adults and is associated with cardiovascular risk factors. In a study done in Kenya, 51%, 21% and 59.5% of osteoarthritis patients were found to have hypertension, diabetes and overweight or obese respectively (19).

It is known that OA patients have chronic, debilitating pain and are on chronic NSAID use. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) use is a key mechanism linking CKD and OA. NSAIDs toxic mechanisms to the renal system are two-fold with both functional and inflammatory mechanisms. Approximately, 1–5% or 2.5 million of the patients using NSAIDs are known to experience adverse renal events annually (20-22). All forms of NSAIDs can result in medicine-induced kidney disease, acute kidney injury, haematuria, proteinuria, flank pain, acute tubular necrosis and interstitial nephritis (22). NSAIDs use contributes to CKD progression (23, 24).

In a retrospective study on young and middle-aged active adults in the United States to assess association between NSAIDs and kidney disease, a modest but statistically significant association was noted between those on high doses of NSAID exposure and kidney disease. A strong association was also noted between CKD and age with a 7-fold increase in hazard ratio in those aged 50 years and older and CKD and ethnicity with higher levels noted in the African-American participants (25). NSAIDs use is prevalent among CKD and OA patients despite their known renal, cardiovascular, and gastrointestinal adverse effects. In Egypt, 65.7% of the patients with CKD were found to use NSAIDs with 36% reporting drug-drug interaction (20). Comorbid CKD has been found among patients with OA. In a knee OA study, 97% of the CKD group had knee OA (26). In an Egyptian CKD study among knee OA and obese patients, 65% of them had CKD (27). The joint risk factors of OA and CKD include old age, being female, hypertension, and diabetes (28,29). Both diseases independently and jointly impacts patients' quality of life, morbidity and mortality (30).

Hence, there was need to assess the prevalence and factors associated with CKD in the OA patients given the high rates of association between OA and chronic conditions associated with chronic kidney disease (hypertension, diabetes, obesity) (19) and its increased prevalence in the aging population. The study was further needed considering that most of the patients with OA are also on chronic NSAIDs use, drugs (31,32) that are known to be nephrotoxic. The study will contribute towards highlighting the kidney function of OA patients,' contribute to increased screening and help tailor pain management that ensures minimal risk of nephrotoxicity and thus improve their overall outcome.

MATERIALS AND METHODS

This was a cross sectional study involving 371 patients aged 18 years and above with ACR criteria-based diagnosis of osteoarthritis from the Orthopaedic and Rheumatology clinics at Kenyatta National Hospital, and was carried out between November 2019 and January 2020. Consecutive sampling was used to recruit patients who met the inclusion criteria. These included patients of both sexes, above 18 years of age with a confirmed diagnosis of knee, hip, spine and hand osteoarthritis according to the American College of Rheumatology Clinical and Radiological criteria. Patients with other types of arthritis such as rheumatoid and lupus arthritis, and ankylosing spondylitis and those with mechanical diseases e.g. disc prolapse were excluded. Written informed consent were obtained from all the participants in the study. Patients were recruited by the principal investigator on all 4 days of the specialized clinics at Kenyatta National Hospital i.e. Tuesday, Wednesday and Friday for orthopaedic clinic and Thursday for Rheumatology clinic. The principal investigator assisted by two research assistants who are trained clinicians administered the questionnaires and collected the relevant laboratory specimens. Data including sociodemographic, previous medical history, anthropometric measurements were collected using a researcher-administered structured questionnaire incorporating the WHO Global Physical Activity Questionnaire (GPAQ) for daily levels of physical activity. Laboratory measurements including blood and urine samples were handled as per the hospital standard operating procedures and delivered to the laboratory and tested within four hours. The blood and urine specimens were taken to the comprehensive care centre laboratory. This laboratory undergoes both internal and external quality control measures.

The main outcome of the study was CKD diagnosis among OA patients. CKD diagnosis was

based on an eGFR of <60 mL/min/1.73m^2 calculated using the Cockcroft-Gault formula and/or proteinuria of ≥30 mg/dl on urinary dipstick for 3 months or more. The independent variables included: age (years), sex (male or female), and education levels, occupation, and completed year since the first diagnosis. The behavioural and anthropometric variables included alcohol use, smoking, and other drug and substance use, body mass index (weight in kilogrammes divided by the squared height in meters) and weight/height ratio. The clinical variables included hypertension (defined according to the JNC 7 classification as either being on treatment or a systolic/ diastolic blood pressure of ≥140/90 mmHg), diabetes (self-reported diabetes, and use of antidiabetic drugs) and current functional state. Other clinical variables included the type and number of joints involved, type of medication used (e.g. NSAIDs, ARBs, ACEIs), types of NSAIDs in use, dosage of the drugs in use, duration of use of medication, history of self-medication or over-the-counter medications and total duration of medication use in years (33).

STATA version 13.1 was used to analyse cleaned data. Mean, median, standard deviation and interquartile range were used for continuous variables while frequencies and percentages were used for categorical variables to characterise the participants' and CKD prevalence among OA patients. Association between the participants' characteristics and the CKD prevalence was assessed using chi-square test. Determinants of CKD among osteoarthritis patients were assessed using a forward stepwise approach multivariable logistic regression analysis. To find the most parsimonious model, variables with a p<0.25 in the bivariate logistic analysis were included. All the analyses were stratified according to sex. Frequencies, percentages, odds ratios and 95% confidence interval were reported. The study was approved by the Ethics and Research Committee of the Kenyatta National Hospital and University of Nairobi.

RESULTS

Respondent characteristics: Three hundred and seventy eight patients were screened for the presence of CKD. We excluded seven patients who did not meet the study criteria leaving us with 371 patients. Most patients were female (77.9%). The mean age was 58.3 years (SD: 11.3 years). Most patients were in the 51 – 64 years age group. Many of the respondents had secondary school education (44.7%), were married (82.5%) and rated their health as fair (49.1%). Only 13.7% and 4.6% had ever consumed alcohol and smoked, respectively. A third of them had a low level of physical activity (32.1%) (Table 1).

Table 1
Respondents' characteristics

Variables	Characteristics	Total (n=371) No. (%)
Age, years	Age, mean (SD)	58.3 (11.3)
	20-34	6 (1.6)
	35-49	75 (20.2)
	5H4	187 (50.4)
	65+	103 (27.8)
Sex	Male	82(22.1)
	Female	289(77.9)
Education levels	Primary and below	148 (39.9)
	Secondary	166 (44.7)
	Tertiary	57 (15.4)
Marital status	Married	306 (82.5) 35
	Single	(9.4) 30 (8.1)
	Widowed/Divorced/ Separated	
Employment	Formal employment	117 (31.5)
	Business	104 (28.0)
	Housework/Farming/ Others	150 (40.4)
Self-rated health	Good	123(33.2)
	Fair	182 (49.1)
	Poor	66 (17.8)
Alcohol	No	320 (86.3)
	Yes	51(13.7)
Smoking	No	354 (95.4)
	Yes	17 (4.6)
Hypertension	No	179 (48.3)
	Yes	192 (51.7)
SBP	Mean(SD), mmHg	137.2 (17.2)
DBP	Mean (SD), mmHg	81.3 (10.3)
Diabetes	No	337 (90.8)
	Yes	34 (9.2)
Weight	Mean (50), kg	76.9 (12.6)
Waist-Hip	Normal	194 (52.3)
Ratio	Obesity	177 (47.7)
Body Mass	Normal	42 (11.4)
Index	Overweight	115 (31.3)
	Obesity	210 (57.2)
Physic activity levels	High	120 (32.4)
	Moderate	132 (35.6)
	Low	119 (32.1)
Diagnosis duration	Years	4.7 (4.7)
Pain within 12 months	No	6 (1.6)
	Yes	365 (98.4)
Stiffness within 12 months	No	36 (9.7) months
	Yes	335 (90.3)
Number of joints involved	1	145 (39.1)
	2	125 (33.7)
	3-8	125 (33.7)

* Chi-square test of association; † Fishers test; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; SD: Standard Deviation

The average weight, waist and hip circumferences were 76.9kg (SD: 12.6), 95.8 cm (10.0) and 111 cm (10.2), respectively. Slightly more than half (51.7%) were hypertensive.

Treatment: Sixty-two per cent of the respondents were using one medication while 7.3% were using 3–4 medications. Four out of every 10 respondents had different medications for treating ailments with 36.7% on antihypertensives, 8.6% on antidiabetics and 99.7% on NSAIDs. Table 2 depicts medication use by gender.

Table 2

Medication use by gender

Variables	Male n (%)	Female n (%)	Total n (%)	P-value*
Number of medications in use				
1(NSAIDS)	62 (75.6)	167 (57.8)	229 (61.7	0.004
2(NSAIDS + AH/AD)	13 (15.9)	102 (35.3)	115 (31.0)	
3–4(NSAIDS + AH + AD+ AS)	7 (8.5)	20 (6.9)	27 (7.3)	
Number of NSAIDS used				
0	0	1 (0.4)	1 (0.3)	
1	65 (79.3)	196 (67.8)	261 (70.4)	
2	15 (18.3)	79 (27.3)	94 (25.3)	0.122†
3	2 (2.4)	4 (1.4)	6 (1.6)	
4	0	9 (3.1)	9 (2.4)	
Antihypertensives				
No	62 (75.6)	173 (59.9)	235 (63.3)	0.009
Yes	20 (24.4)	116 (36.7)	136 (36.7)	
Antidiabetics				
No	75 (91.5	264 (91.4)	339 (91.4)	0.974
Yes	7 (8.5)	25 (8.6)	32 (8.6)	
Arthritis medication in 12 months				
No	6 (7.3)	3 (1.0)	9 (2.4)	0.005†
Yes	76 (92.7)	286 (99.0)	362 (97.6)	
Total prescription time				
1–90 days	6 (7.3)	8 (2.8	14 (3.8)	0.056
>90 days	76 (92.7)	281 (97.2)	357 (96.2)	

* Chi-square test of association; † Fishers test; IQR: Interquartile Range; AH Antihypertensives; AD Anti diabetics; AS Anti Statins

Prevalence of Chronic Kidney Disease (CKD): The overall prevalence of CKD among patients with OA was 61.9% (95% CI: 56.4–66.3). The sex-specific prevalence of CKD was higher among males than females (65.9%, 95% CI: 54.7–75.5 vs. 60.2%, 95% CI: 54.4–65.7). The mean eGFR was 56.3 (13.0) mL/min/1.73m^2. A majority of the respondents had CKD stage 3 (59.3%) based on the CG formula and only 12.1% had persistent proteinuria.

Figure 1

Prevalence of CKD by stages

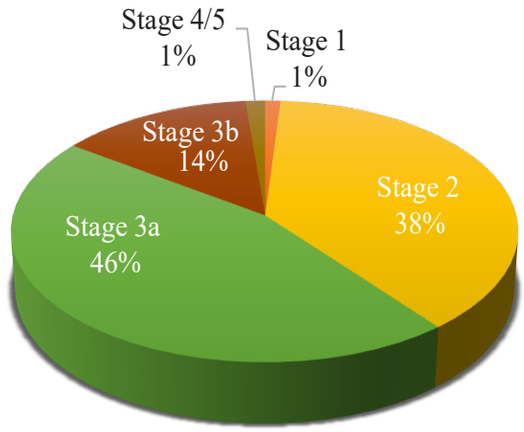

Table 3

Prevalence of Chronic Kidney Disease (CKD) and its staging

Character-istic	CKD-CG % (95% CI)	CKD-Epi % (95% CI)	CKD-MDRD % (95% CI)	Proteinuria† % (95% CI)
Overall*	61.9 (56.4–66.3)	77.1 (72.5–81.1)	67.9 (63.0–72.5)	12.1 (9.2–15.9)
Age, years				
20–34	33.3 (4.2–85.1)	16.7 (0.9–81.4) 60.0	0	33.3
35–49	17.3 (10.2–	(48.3–70.6) 78.6	58.7 (47.0–69.4)	(4.2–85.1)
50–64	27.9) 63.1	(72.1–83.9) 90.3	67.9 (60.8–74.3)	6.7 (2.7–15.3)
65+	(55.9–69.8)	(82.7–94.8)	78.6 (69.5–85.6)	12.3 (8.3–
	92.2			17.9) 15.6
	(85.1–96.1)			(8.9–22.9)
Sex				
Male	65.9 (54.7–75.5)	54.9 (43.8–65.5)	35.4 (25.6–46.5)	11.0 (5.7–20.0)
Female	60.2 (54.4–65.7)	83.4 (78.6–87.3)	77.2 (71.9–81.7)	12.5 (9.1–16.8)
Staging				
Mean eGFR (SD)	56.3 (13.0)	54.4 (9.9)	56.8 (9.6)	
Stage 1	4 (1.1)	2 (0.5)	2 (0.5)	
Stage 2	142 (38.3)	93 (25.1)	118 (31.8)	
Stage 3a	169 (45.6)	221 (59.6)	222 (59.8)	
Stage 3b	51 (13.7)	54 (14.6)	28 (7.6)	
Stage 4/5	5 (1.4)	1 (0.3)	1 (0.3)	

eGFR: Estimated Glomerular Filtration Rate; CG: Cockcroft-Gault; MDRD: Modification of Diet in Renal Disease Study; CKD-Epi: Chronic Kidney Disease Epidemiology Collaboration * The 1 person had a urine protein of 3+

Among the respondents with CKD, majority were aged 50–64 years (51.8%) and above 65 years (41.7%),

female (76.3%), with primary level of education (50.4%), rated their health as fair (61%), and self-medicated (90.4%). Table 4 depicts the prevalence of CKD according to the respondents' characteristics.

Table 4

Prevalence of CKD according to the respondents' characteristics

Variables	Characteristic	CKD n (%)	No CKD n (%)	p-value*
Age, years	Average age	63.0 (10.0)	50.7 (8.9)	<0.001§
	20–34	2 (0.9)	4 (2.8)	
	35–49	15 (6.6)	66 (46.2)	
	50–64	118 (51.8)	69 (48.3)	<0.001
	65+	95 (41.7)	8 (5.6)	
Sex	Male	54 (23.7)	28 (19.6)	0.354
	Female	174 (76.3)	115 (80.4)	
Education levels	Primary and below	115 (50.4)	33 (23.1)	
	Secondary	90 (39.5)	76 (53.2)	<0.001
	Tertiary	23 (10.1)	34 (23.8)	
Employment	Formal employment	55 (24.2)	62 (43.4)	
	Business	59 (25.9)	45 (31.5)	<0.001
	Housework/Farming/Others	114 (50.0)	36 (25.2)	
Self-rated Health	Good	37 (16.2)	86 (60.1)	
	Fair	139 (61.0)	43 (30.1)	<0.001
	Poor	52 (22.8)	14 (9.8)	
Alcohol	No	198 (86.8)	122 (85.3)	0.678
	Yes	30 (13.2)	21 (14.7)	
Smoking	No	214 (93.9)	140 (97.9)	0.070†
	Yes	14 (6.1)	3 (2.1)	
Physical Activity	High	81 (35.5)	39 (27.3)	
	Moderate	80 (35.1)	52 (36.4)	0.199
	Low	67 (29.4)	52 (36.4)	
WHR	Normal	112 (49.1)	82 (57.3)	0.123
	Obese	116 (50.9)	61 (42.7)	
BMI	Normal	33 (14.5)	9 (6.4)	
	Overweight	77 (33.9)	38 (27.1)	0.008
	Obese	117 (51.5)	93 (66.4)	
Hypertension	Non-hypertensive	69 (30.3)	110 (76.9)	<0.001
	Hypertensive	159 (69.7)	33 (23.1)	
Diabetes	No	200 (87.7)	137 (95.8)	0.009
	Yes	28 (12.3)	6 (4.2)	
All medications	1 (Nsaids only)	112 (49.1)	117 (81.8)	
	2 (Nsaids + AH/AD)	93 (40.8)	22 (15.4)	<0.001
	3-4 (Nsaids + AH + AD + AS)	23 (10.1)	4 (2.8)	
Total Prescription Time	1–90	8 (3.5)	6 (4.2)	0.735
	>90	220 (96.5)	137 (95.8)	
Joints Involved	Median, IQR	2 (1–3)	1 (1–2)	0.001
Self-medication	No	22 (9.7)	10 (7.0)	0.375
	Yes	206 (90.4)	133 (93.0)	

* Chi-square test of association; † Fishers test; § Student's t-test; IQR: Interquartile Range; CKD: Chronic Kidney Disease; BMI: Body Mass Index; WHR: Waist-Hip Circumference; AD: Antidiabetics; AH: antihypertensives; AS: Anti-Statins

Factors associated with CKD in patients with osteoarthritis: Table 5 highlights the association between the respondent's characteristics and chronic kidney disease. In the bivariate analysis, old age, higher education levels, household/farming work, poor self-rated health, number of joints involved, number of medications in use, diabetes and hypertension were independently associated with chronic kidney disease.

Table 5

Association between respondents' characteristics and prevalence of chronic kidney disease

Variables	Characteristics	Bivariate		Multivariable	
		COR (95% CI)	p-value	AOR (95% CI)	p-value
Age, years	20–49	Ref		Ref	
	50–64	7.52 (3.99–14.2)	<0.001	21.4 (7.00–65.9)	**<0.001**
	65+	52.2 (21.0–130.1)	<0.001	(26.6–538.4)	**<0.001**
Sex	Male	Ref		Ref	
	Female	0.78 (0.47–1.31)	0.354	2.58 (0.94–7.12)	0.067
Education	Primary and below	Ref		Ref	
levels	Secondary	0.34 (0.21–0.56)	<0.001	0.89 (0.39–2.06)	0.803
	Tertiary	0.19 (0.10–0.37)	<0.001	0.45 (0.13–1.55)	0.208
Employment	Formal employment	Ref		Ref	
	Business	1.48 (0.87–2.51)	0.15	1.32 (0.52–3.37)	0.564
	Housework/Farming	3.57 (2.12–6.01)	<0.001	0.75 (0.29–1.96)	0.557
Self-rated	Good	Ref		Ref	
Health	Fair	7.51 (4.49–12.6)	<0.001	7.08 (2.67–18.7)	**<0.001**
	Poor	8.63 (4.23–17.5)	<0.001	11.9 (3.36–42.7)	**<0.001**
Alcohol	No	Ref			
	Yes	0.88 (0.48–1.61)	0.678	1.08 (0.32–3.60)	0.900
Smoking	No	Ref		Ref	
	Yes	3.05 (0.86–10.8)	0.084	1.18 (0.13–11.0)	0.884
Physical	High	Ref		Ref	
Activity	Moderate	0.74 (0.44–1.24)	0.256	0.24 (0.10–0.58)	**0.002**
Levels	Low	0.62 (0.37–1.05)	0.075	0.51 (0.21–1.26)	0.145
Diabetes	No	Ref		1.02 (0.97–1.06)	0.417
	Yes	3.20 (1.29–7.93)	0.012	8.88 (0.58–137.0)	0.118
	No	Ref			
	Yes	7.68 (4.75–12.4)	<0.001	22.6 (6.18–83.0)	**<0.001**
Number of	1	Ref		Ref	
Affected	2	6.65 (3.79–11.7)	<0.001	2.38 (0.99–5.74)	0.053
Joints	3-8	3.09 (1.81 – 5.26)	<0.001	0.79 (0.27–2.25)	0.653
All	1 (Nsaids only)	Ref		Ref	
medication	2 (Nsaids + AH/AD)	4.42 (2.59 – 7.52)	<0.001	0.37 (0.10–1.36)	0.134
s	3-4 (Nsaids + AH + AD + AS)	6.01 (2.01 – 17.9)	0.001	0.01 (0.00–0.47)	**0.019**
Total	1–90	Ref		Ref	
Prescriptio	>90	1.20 (0.41– 3.54)	0.736	3.10 (0.59–16.3)	0.180
n Time					
BMI	Normal	Ref			
	Overweight	0.55 (0.24 –1.27)	0.163	0.19 (0.04–0.80)	**0.023**
	Obese	0.34 (0.16–0.75)		0.02 (0.004–0.10)	**<0.001**
WHR	Normal	Ref			
	Obese	1.39 (0.91–2.12)	0.123	0.69 (0.32–1.51)	0.358

Note: TPT: Total Prescription Time (days); Ref: Reference category; COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval.

After adjusting for all confounders in the multivariable logistic regression, old age, poor and fair self-rated health, and hypertension increased the odds of CKD among patients with osteoarthritis. The odds of CKD increased 120 times among participants aged 65 years and above compared to those aged 20-49 years. Participants who rated their health as being poor had 12 times increased odds of CKD compared to those who rated their health as good. Hypertensive participants had 22 times increased odd of CKD compared to non-hypertensive participants. In contrast, moderate levels of physical activity, overweight, obesity and use of medications were protective of CKD. Participants with moderate level of physical activity, overweight, obesity, and using 3–8 medicines had 76%, 81%, 98%

and 99% reduced odds of CKD compared to those with high levels of physical activity, normal BMI and using one medicine, respectively. The association of number of medications in use and CKD changed from a risk factor to a protective factor on adjusting for confounders.

DISCUSSION

The overall prevalence of CKD among patients with OA was 61.9%. The prevalence was higher among males than females and most of the respondents had CKD stage 3. CKD is known to be prevalent among OA patients. The CKD prevalence in this study is similar to the 65% in Egypt among patients with knee OA and obese (27). The CKD prevalence was higher than the 28.7% among rheumatoid arthritis patients at KNH (34). Most of our respondents were obese, hypertensive, and physically inactive which could explain the high prevalence of CKD. Studies have shown that the prevalence of CKD is high among patients diagnosed with hypertension and diabetes (6). The prevalence is higher than in other high risk groups such as HIV patients where it ranges between 4.8% and 12.3% (35), hypertensive (35.6%), diabetes (32.6%) (6). Similar to other high-risk populations, a majority of participants in this study had CKD stage 3 (36).

The study found that old age, poor and fair self-rated health and hypertension increased the odds of CKD among patients with OA. Older adults tend to have a high prevalence of CKD, hypertension and diabetes (37,38). In Tanzania, older age was identified as a factor associated with impaired kidney function (3) while in Uganda it has been shown to increase odds of CKD (38). Hypertension is known to increase the risk of CKD. Hypertension is associated with increased damage of blood vessels within the kidney resulting in altered kidney function (poor waste and water removal). Hypertension causes approximately 25–48.7% of CKD in SSA (39). On the other hand, diabetes was significantly associated with CKD in the bivariate analysis, but the effect disappeared after adjusting for confounder. This could be attributed to the small number of osteoarthritis patients living with diabetes in our sample.

Self-rated health reflects a person's perception of the health and acts as a proxy to their quality of life. Thus, participants who rated their health as being fair or poor had increased odds for CKD. This could highlight existing health problems and possibly complications related to the health problems. CKD is a known comorbid condition, complication of other illnesses and diseases and side effect of some medications. CKD has major impacts on health, healthcare cost and productivity (3). Both OA and CKD independently and jointly impact patients' quality of life, morbidity and mortality (30) hence the poor self-rated health.

In addition, the study found that moderate levels of physical activity and use of medications were protective of CKD. The findings highlight the importance of physical activity among patients with OA especially noting that physical inactivity is an independent determinant of CKD and ESRD (40). The protective effects of use of medication could be resulting from medication used to manage comorbidities primarily ARBs/ACEI used in management of hypertension. Proper management of comorbidities is key in managing OA and reducing the likelihood of developing complications such as CKD. Some medications such as ACEI/ARBs are reno-protective hence the protective effects on CKD.

Overweight and obesity reduced the odds of CKD among OA patients in this study, which confirms findings from Uganda which also found overweight and obesity were protective against CKD (41). Obesity and overweight are determinants of hypertension, proteinuria, glycosuria and CKD (42). They increase proteinuria in the body, and cause hyperfiltration and loss of estimated glomerular filtration rates over time (43). The exact mechanism of how they are protective of CKD is unclear. However, this study used Cockcroft-Gault (CG) formula to estimate the prevalence of CKD yet CG tends to overestimate GFR in obese/overweight patients.

In the bivariate analysis, the study found that those who were involved in housework/farming had increased odds of CKD. Farming is associated with use of pesticides with chemicals which are known to be nephrotoxic. In a study in Kericho Kenya, the use of agrochemicals in farming among the majority of agricultural communities contributed to the prevalence of CKD (7). However, those who were involved in housework/farming had reduced odds on adjusting for confounders. This shows that the potential effects of farming are neutralised by other factors.

In this study, gender was not associated with CKD despite more females than males having a high prevalence of CKD. This could be attributed to the large sample of females in our study. However, similar to other studies, gender is not independently associated with CKD among patients with OA in our study setting.

However, our study still had various limitations. First, the study used a single measurement of serum creatinine and GFR to determine CKD prevalence resulting in a potential under- or over-estimation of

the prevalence. Second, the study is cross-sectional in nature thus no causation can be inferred. Third, the study relied on patients recall for some information such as the history of the diseases or behavioural risk factors. Patients may be unable to correctly recall some of the information and may supply inaccurate information. However, information provided by patient was counter checked against their medical records for verification. Lastly, the use CG equation to estimate GFR with its shortcomings including over-estimating GFR in overweight/obese might have resulted in potential under-estimation of prevalence of CKD in this population. However, mean GFR was estimated using all three formulas (CG, MDRD and CKD-Epi) and was comparable across the three.

CONCLUSIONS

The study found that the prevalence of CKD is high among patients with OA with six out of every 10 OA patients being diagnosed with CKD. The study also found that the prevalence was higher among males than females and that most patients had CKD stage 2 and 3. Old age, poor and fair self-rated health, and hypertension increased the odds of CKD while moderate levels of physical activity, overweight, obesity and use of more than one medication either NSAIDs plus ARB/ACEI or antidiabetics decreased the odds of CKD among patients with OA.

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