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The Association Between Potassium Intake and Risk of Chronic Kidney Diseases

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Objectives: High potassium intake is closely related to lower risk of cardiovascular disease. However, the association between potassium intake and chronic kidney disease (CKD) development in the general population is uncertain.

Methods: From UK biobank cohort, we included 317,162 participants without CKD between 2006 and 2010. The main predictor was spot urine potassium-to-creatinine ratio (KCR) as a surrogate of potassium intake. The primary outcome was incident CKD, defined based on ICD-10 and OPCS-4 codes. For secondary analysis, we included 141,180 participants who completed 24-h dietary recall questionnaire and dietary potassium intake-to-weight was an additional predictor.

Results: At baseline, individuals with higher KCR had lower levels of blood pressure, body mass index, and inflammation, and were less likely to have diabetes and hypertension than those with lower KCR. During a median follow-up of 11.9 years, the primary outcome events occurred in 15,255 (4.8%) participants. In Cox proportional hazard model, adjusted hazard ratio (aHR) per 1-standard deviation increase in KCR for incident CKD was 0.90 (95% confidence interval [CI], 0.89-0.92). In addition, compared with quartile 1 of KCR, the aHRs (95% CIs) for second, third, and fourth quartile were 0.98 (0.94–1.02), 0.90 (0.86–0.94), and 0.80 (0.76–0.84), respectively. In secondary analysis, higher potassium consumption was also inversely associated with risk of CKD. Compared with quartile 1 of dietary potassium intake, the corresponding aHRs (95% CIs) for each quartile were 0.85 (0.78–0.92), 0.73 (0.67–0.81), and 0.67 (0.60–0.75), respectively.

Conclusions: Higher urinary potassium excretion and potassium intake were associated with lower risk of incident CKD.

Table 1. Incidence of primary outcome according to quartiles of spot urinary KCR

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	Total	Spot Urinary KCR			
		Quartile 1	Quartile 2	Quartile 3	Quartile 4
Number of participants	317162	79290	7,291	79290	79291
Person-year	1512.1	1688.9	1664.6	14906	1207.5
Events (%)	15255 (4.8)	4247 (5.4)	4182 (5.3)	3759 (4.7)	3067 (3.9)
Events per 1,000-person year	10088.9	2514.7	2512.4	2521.8	2540.0

Note: Primary outcome was incident CKD, defined based on ICD-10 and OPCS-4 codes.

Abbreviation: KCR, potassium-to-creatinine ratio; CKD, chronic kidney disease; ICD, international classification of diseases; OPCS, operating procedure codes supplement

Table 2. HRs for the incident CKD outcomes according to spot urinary KCR and dietary potassium intake

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Main cohort	Model 1		Model 2		Model 3	
	HR (95% CI)	***P***	**HR (95% CI)**	***P***	**HR (95% CI)**	***P***
Continuous						
per SD increase	0.86 (0.85 - 0.88)	<0.001	0.86 (0.84 - 0.88)	<0.001	0.90 (0.89 - 0.92)	<0.001
Quartile						
Q1	*reference*		*reference*		*reference*	
Q2	0.99 (0.94 - 1.03)	0.509	0.92 (0.89 - 0.97)	<0.001	0.98 (0.94 - 1.02)	0.308
Q3	0.88 (0.85 - 0.92)	<0.001	0.83 (0.79 - 0.86)	<0.001	0.90 (0.86 - 0.94)	<0.001
Q4	0.72 (0.68 - 0.75)	<0.001	0.70 (0.67 - 0.74)	<0.001	0.80 (0.76 - 0.84)	<0.001
Secondary cohort	**Model 1**		**Model 2**		**Model 3**	
	HR (95% CI)	***P***	**HR (95% CI)**	***P***	**HR (95% CI)**	***P***
Continuous						
per SD increase	0.84 (0.81 - 0.87)	<0.001	0.84 (0.82 - 0.87)	<0.001	0.83 (0.79 - 0.87)	<0.001
Quartile						
Q1	*reference*		*reference*		*reference*	
Q2	0.85 (0.79 - 0.92)	<0.001	0.84 (0.78 - 0.91)	<0.001	0.85 (0.78 - 0.92)	<0.001
Q3	0.72 (0.66 - 0.78)	<0.001	0.72 (0.66 - 0.78)	<0.001	0.73 (0.67 - 0.81)	<0.001
Q4	0.65 (0.60 - 0.70)	<0.001	0.66 (0.60 - 0.71)	<0.001	0.67 (0.60 - 0.75)	<0.001

Model 1: unadjusted

Model 2: age, sex, BMI, Townsend deprivation index, handgrip strength, alcohol history, smoking history, SBP, medication history including statin, RAAS blocker, diuretics, past medical history including diabetes, cardiovascular disease

Model 3: Model 2+ laboratory parameters including hemoglobin, albumin, log-transformed hs-CRP, total cholesterol, log-transformed urinary NaCr. In secondary analysis dietary energy, dietary protein, and dietary fiber intake were further adjusted.

Note: Primary outcome was incident CKD, defined based on ICD-10 and OPCS-4 codes. Secondary cohort includes participants who completed 24-hour dietary recall questionnaire and dietary potassium intake was used as a predictor.

Abbreviations: CKD, chronic kidney disease; KCR, potassium-to-creatinine ratio; HR, hazard ratio; CI, confidence intervals; SD, standard deviation; BMI, body mass index; SBP, systolic blood pressure; RAAS, renin-angiotensin-aldosterone system; hs-CRP, high sensitivity C reactive protein; NaCr, sodium-to-creatinine ratio; ICD, international classification of diseases; OPCS, operating procedure codes supplement.