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Association of Urinary Sodium-to-Potassium Ratio with CKD Progression: A Comparative Analysis of CRIC and KNOW-CKD Cohorts

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Objectives : The urinary sodium-to-potassium (Na/K) ratio is a potential marker for chronic kidney disease (CKD) progression. However, its impact may differ between populations due to dietary and genetic differences. We aimed to investigate the association between the urinary Na/K ratio and CKD progression in two independent cohorts.
Methods : A total of 4,062 patients were included from the Chronic Renal Insufficiency Cohort (CRIC) and the Korean Cohort Study for Outcome in Patients with CKD (KNOW-CKD). The primary exposure was urinary Na/K ratio, determined using 24h urine collection. The primary outcome was CKD progression, defined as a ≥50% decline in estimated glomerular filtration rate (eGFR), initiation of dialysis, or kidney transplantation.
Results : The KNOW-CKD cohort had a higher proportion of men (66.2% vs. 54.6%, p<0.001), whereas age (p=0.172) and systolic blood pressure (p=0.455) were comparable. Over a median follow-up of 7.47 years, the primary outcome occurred in 1,525 patients with the corresponding incidence rate of 45.3 per 1,000 person-years. A graded association was observed between urinary Na/K ratio and the risk of CKD progression. Compared with quartile 1, the adjusted HRs (95% CIs) were 1.13 (0.97, 1.31), 1.23 (1.05, 1.44), and 1.24 (1.06, 1.45) for quartile 2, 3, and 4, respectively. This association was consistent across the KNOW-CKD cohort (HR for quartile 4 vs. quartile 1, 2.45; 95% CI, 1.58–3.69) and CRIC cohort (HR, 1.28 [0.95–1.34]). The interaction analysis revealed a significant cohort difference (p=0.018), with a stronger association observed in the KNOW-CKD cohort.
Conclusions : A higher urinary Na/K ratio is associated with an increased risk of CKD progression in both cohorts, with a stronger association observed in the KNOW-CKD cohort. These findings highlight potential ethnic or dietary influences on CKD progression and suggest that dietary modification of sodium and potassium intake may play a critical role in delaying CKD progression, particularly in East Asian populations.

table 1_NaK_R.png

Table 1. Hazard ratios for the CKD progression according to 24hr Urine Na/K Ratio

	Quartiles of 24hr Urine Na/K Ratio				Per 1.0 increase in Na/K Ratio
	Q1	Q2	Q3	Q4	
CKD progression	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
Model 1	Reference	1.17 (1.01, 1.36)	1.33 (1.15, 1.54)	1.61 (1.40, 1.86)	1.18 (1.12, 1.24)
Model 2	Reference	0.95 (0.81, 1.11)	1.00 (0.86, 1.17)	1.13 (0.97, 1.31)	1.05 (0.99, 1.11)
Model 3	Reference	0.96 (0.82, 1.13)	1.00 (0.85, 1.16)	1.23 (1.05, 1.44)	1.07 (1.01, 1.13)
Model 4	Reference	0.97 (0.82, 1.13)	0.99 (0.85, 1.16)	1.24 (1.06, 1.45)	1.07 (1.01, 1.13)

Model 1: unadjusted
Model 2: + age, sex, BMI, race, 24hr urine creatinine, systolic blood pressure, alcohol status, smoking status, education, medical history (diabetes, cardiovascular disease)
Model 3: + 24hr urine protein, eGFR, serum albumin, serum hemoglobin, HDL cholesterol, serum phosphorus
Model 4: + use of medications (RAS blocker, diuretics, statin)

table 1_NaK_R.png

Table 2. Between cohort difference

Variable	HR (95% CI)	*p* value
Interaction term: Urine Na/K Quartile x Cohort (Reference: CRIC)		
Q4 * KNOW-CKD	1.28 (1.07, 1.54)	0.018
Interaction term: Na/K Ratio x Cohort (Reference: CRIC)		
Na/K Ratio * KNOW-CKD	1.22 (1.01, 1.47)	0.035

Model was fully adjusted for covariates including interaction term between Urine Na/K Ratio and Cohort group.