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The K-SALT Equation: Development and Validation of a Population-Specific Formula for Estimating 24-Hour Urinary Sodium Excretion in Korean Patients with Chronic Kidney Disease

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Objectives : Accurate estimation of 24-hour urinary sodium (24hUNa) excretion is essential for assessing sodium intake and guiding salt restriction in patients with chronic kidney disease (CKD). However, existing equations have shown limited validity in Korean populations. Therefore, we aimed to develop and validate the Korean Sodium Assessment Tool (K-SALT), an equation for estimating 24hUNa excretion from spot urine specifically designed for Korean patients with CKD.

Methods : This study employed a hybrid cohort design across 16 teaching hospitals in Korea. Data for the development and internal validation cohorts were prospectively collected according to a standardized urine collection protocol, whereas data for the external validation cohort were retrospectively obtained from an independent patient group. Multiple regression models were constructed using demographic, anthropometric, and spot urine variables, and their performance was compared with existing equations using intraclass correlation coefficients (ICC), mean bias, and area under the curve (AUC) analyses.

Results : A total of 1,637 patients with CKD were included in this study (1,077 for the development and internal validation, and 560 for the external validation). The K-SALT equation demonstrated superior performance compared with previously reported formulas, showing higher ICC and AUC values with smaller mean prediction error. External validation confirmed its robustness across CKD stages and subgroups.

Conclusions : The K-SALT study provides the first large-scale, population-specific equation for estimating 24hUNa excretion in Korean patients with CKD. By better reflecting the demographic and



clinical characteristics of this population, the K-SALT equation enables more accurate assessment of sodium intake and supports individualized dietary sodium management in CKD care.

Table 1.JPG

Table 1. Developed equation for estimating 24-hour urinary sodium excretion

Male	$24 \text{ hour urine Na} = 0.021497 \times \text{age}^{0.085} \times \text{height}^{0.863} \times \text{weight}^{0.829} \times \text{spot urine Na}^{0.225} \times \text{spot urine K}^{0.043} \times \text{spot urine Cr}^{-0.129} \times \text{serum Cr}^{-0.107}$
Female	$24 \text{ hour urine Na} = 0.001316 \times \text{age}^{-0.277} \times \text{height}^{1.878} \times \text{weight}^{0.436} \times \text{spot urine Na}^{0.485} \times \text{spot urine K}^{0.199} \times \text{spot urine Cr}^{-0.380} \times \text{serum Cr}^{0.097}$

Table 1.JPG

Figure 2A. Bland-Altman plots of measured 24-hour urine Na excretion and estimated 24-hour urine Na excretion by (A) K-SALT, (B) Kawasaki, (C) Tanaka, (D) INTERSALT, (E) Nerbass equation (Internal validation)

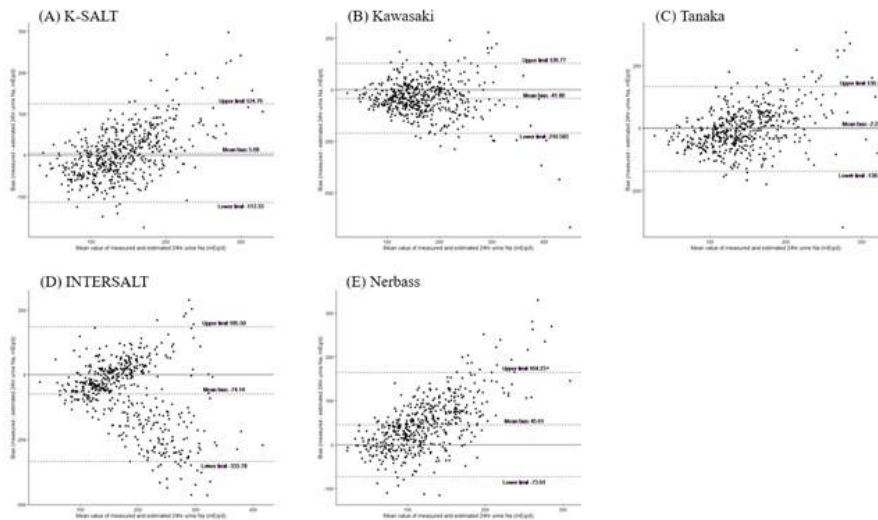


Figure 2B. Bland-Altman plots of measured 24-hour urine Na excretion and estimated 24-hour urine Na excretion by (A) K-SALT, (B) Kawasaki, (C) Tanaka, (D) INTERSALT, (E) Nerbass equation (External validation)

