■ Editorial

Sodium Intake Estimated from Spot Urine Samples and the Prevalence of Metabolic Syndrome in the Korea National Health and Nutrition Examination Survey

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It is well known that high sodium intake is associated with high blood pressure, and an increased risk of cardiovascular diseases. The World Health Organization recommends a sodium intake restriction to <2 g/d (<5 g/d of salt) in adults to reduce blood pressure and the risk of cardiovascular diseases.¹⁾ In the present issue, Seo et al.²⁾ evaluated the association between sodium intake estimated from spot urine samples and the prevalence of metabolic syndrome in Korean adults using the data of the Korea National Health and Nutrition Examination Survey (KNHANES). Recently, several articles on the same topic using KNHANES data have been published³⁻⁵⁾ and have shown consistently that sodium intake has a positive association with the prevalence of metabolic syndrome in Korean adults. This association is stronger among women than among men.

Sodium intake has traditionally been estimated using the 24-hour dietary recall for 1-day in KNHANES.⁶⁾ However, 24-hour dietary recall is labor intensive and has several limitations such as under-reporting of intake, difficulties in quantifying the amount of sodium in recipes, and discretionary salt use.⁷⁾ Furthermore, since the Korean Standard Food Composition Table is revised every 5 years, assessment of the annual trends of sodium intake through dietary recall is limited.⁶⁾ In order to overcome the limitations of dietary assessment, urine biomarkers was supposed to be introduced to estimate sodium intake in KNHANES. Even though 24-hour urine collec-

tion is recommended as the gold standard method for assessing sodium intake, collection of 24-hour urine samples is not practical in large-scale epidemiological surveys like KNHANES. The participation rate in population-based studies using 24-hour urine collection is generally lower than 70%. After further exclusion of subjects with incomplete urine samples, less than half of the subjects may remain in the final analysis.⁸⁾ Spot urine sampling is suggested as a practical and attractive alternative to 24-hour urine collection in population surveys.⁷⁾ From 2008, sodium concentrations in fasting urine samples (first morning sample, if possible) have been measured by an ion-selective electrode method in KNHANES. Spot urine sodium concentration can be converted into an estimate of 24-hour urinary sodium excretion (24HUNa) based on prediction equations. Several prediction equations for estimating 24HUNa from spot urine samples have been proposed. While Tanaka's equation and Kawasaki's equation were based on Japanese populations, INTERSALT equations were developed from a Western population.⁷⁾

Tanaka's equation or Kawasaki's equation was used to estimate 24HUNa from spot urine sodium concentration in most of the published articles using KNHANES data.³⁻⁵⁾ Seo et al.²⁾ also used Tanaka's equation. Since the validity of prediction equations varies according to ethnicity, validation studies are recommended to identify the most suitable prediction equation in different population groups.⁷⁾ While INTERSALT equa-

tions, which were developed for Western populations, provided the least biased estimates of 24HUNa among American adults,⁹⁾ the bias in estimating 24HUNa was the least with Kawasaki's equation among Chinese adults.¹⁰⁾ Rhee et al.¹¹⁾ developed and validated prediction equations using first morning urine samples to estimate 24HUNa in a Korean population. They also validated previously proposed prediction equations. Their equations were less biased to estimate 24HUNa compared to previously proposed equations. However, they concluded that because all equations had huge limits of agreement and a tendency of under- or over-estimation of 24HUNa depending on the level of measured 24HUNa, these prediction equations based on single spot urine samples were inadequate for the estimation of an individual's sodium intake. They proposed a prediction equation to estimate 24HUNa using the average of three spot urine samples (morning-first, morning, and evening) in another article.¹²⁾ Using the average of multiple spot urine samples collected at different times may eliminate the bias due to diurnal variations in urine sodium excretion. They showed that the prediction equation that used multiple spot urine samples provided an improved estimation of 24HUNa at a population level compared to the equations that used a single spot urine sample.

Diuretics, which can affect sodium excretion, are widely used to treat hypertension. However, because detailed medication history is not documented in KNHANES, Seo et al.²⁾ could not adjust their data for the use of diuretics, which was reported as one of their study's limitations. Won et al.⁵⁾ presented an interesting finding that while 24HUNa was positively associated with the prevalence of metabolic syndrome in subjects not on antihypertensive medication, there was no such significant association in subjects on antihypertensive medication. Patients taking antihypertensive medication are more likely to receive counseling for lifestyle modification. Therefore, they try to consume less salt, which may be a confounding factor in the association between 24HUNa and the prevalence of metabolic syndrome.

In order to achieve the goal of reducing sodium intake, assessment and monitoring of sodium intake is essential not only at the population level but also at an individual level. Estimating sodium intake accurately is not easy. There are no reliable and simple methods for assessing sodium intake. The Japanese Society of Hypertension recommended appropriate methods for assessing salt intake according to the subject and facility's environment.¹³⁾ Although all methods for assessing sodium intake have some limitations, I believe that estimating sodium intake with appropriate methods, according to clinical circumstances, contributes to the goal of reducing sodium intake.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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