Spot urine sample for estimating sodium intake of a population

McLean R, Williams S, Mann J. (Department of Human Nutrition; Department of Preventive and Social Medicine, Dunedin School of Medicine, University of Otago; Department of Preventive and Social Medicine; Department of Medicine, Dunedin School of Medicine, University of Otago, Dunedin, New Zealand.) Monitoring population sodium intake using spot urine samples: Validation in a New Zealand population. *J Hum Hypertens* 2014;28:657–62.

**SUMMARY**

Non-communicable diseases (NCDs) are a leading cause of mortality and morbidity and reduction of intake of salt (sodium) has been identified as a key strategy to reduce hypertension and its complications. Twenty-four-hour urinary sodium excretion is considered the ‘gold standard’ for assessment of sodium intake. However, due to difficulties of logistics and estimation, alternative approaches are being explored. These include the estimation of spot urine sodium.

This study aimed to assess the validity of using a spot urine sample to estimate the sodium intake of the population. One hundred and one healthy volunteers between 18 and 65 years of age were recruited from Dunedin city, New Zealand. Information on demography, dietary habits and physical measurements (height, weight and blood pressure) was collected. A random spot urine sample and a 24-hour urine sample were collected (as described in WHO Pan American Health Organization [PAHO] protocols) from each participant. Participants were instructed to maintain a normal diet during the collection period. A second 24-hour (with spot) urine collection was collected from 9 participants to assess the repeatability of the calculated estimations. Four formulae described in earlier studies were used to convert spot urinary sodium into estimates of 24-hour excretion: (i) the PAHO formula (ePNa24h), (ii) INTERSALT (eINa24h), (iii) Tanaka et al. (eTNa24h) and (iv) Kawasaki et al. (eKNa24h).

Ninety-eight participants (68 women and 30 men) completed urine collection as per the protocol. The mean (SD) of the measured 24-hour sodium excretion was 3459 (1599) mg. The mean (SD) of the estimated 24-hour sodium excretion using different formulae were 3595 (2156) mg using the PAHO formula, 2908 (691) mg using INTERSALT, and 3610 (922) mg and 4575 (1493) mg using the formulae suggested by Tanaka et al. and Kawasaki et al., respectively. The correlation coefficients between measured and estimated urinary sodium values were 0.61 with the PAHO formula, 0.63 with INTERSALT, 0.58 with Tanaka et al. and 0.56 with Kawasaki et al. The kappa coefficients of urinary sodium excretion above 2300 mg per 24 hours were 0.48 with PAHO, 0.37 with ePMNa24h, 0.18 with INTERSALT, 0.33 with Tanaka et al. and 0.24 with Kawasaki et al. The agreement between the spot and 24-hour urine sample collection methods at the cut-off value of 2300 mg per 24 hours ranged from 72% to 80% for the four formulae. The estimates using the PAHO and the INTERSALT formulae were in closer agreement with 24-hour excretion than the estimates using the Tanaka et al. and Kawasaki et al. formulae.

Overall, the PAHO estimates most closely resembled the measured 24-hour sodium excretion. The INTERSALT formula accurately estimated the proportion that exceeded the upper limit of 2300 mg. The Tanaka and Kawasaki formulae were found to be inaccurate for use in the studied population. No appreciable advantage was seen on collecting spot urine on two occasions and results were comparable to a single spot urine collection. Single spot urinary sodium levels provided a good approximation of the population urinary sodium level and can be used for monitoring and surveillance of sodium intake programmes.

**COMMENT**

Similar to the global trend, in India too NCDs are a leading cause of mortality and an important public health problem. India, being a signatory to the 2011 UN NCD Summit, is committed to the goal of reduction of NCD mortality by 25% and salt intake by 30% by the year 2025. However, limited information is available regarding sodium intake levels in the Indian population. The ICMR Task Force report of 1996 and the INTERSALT study done in 1988 are the only two data sources available. Both the studies are unlikely to be representative of the current salt intake in India, and have limitations in terms of methods used to ascertain salt intake as well as generalizability at the national level.

Twenty-four-hour urinary collection is considered the gold standard for assessing sodium intake as kidneys excrete nearly 95% of sodium intake. However, 24-hour urine collection causes considerable inconvenience to study participants and is susceptible to bias due to under-collection. Collection of a 24-hour urine sample may not be feasible for use in large epidemiological surveys and surveillance systems. Sodium excretion in the urine of an individual varies from day-to-day and 5 to 10 repeat 24-hour collections are required to accurately calculate average salt intake. Spot urine sodium measurement is not a valid estimation of sodium intake at the individual level. Due to low cost, faster screening time, requirement of less training for survey staff and ease of collection, spot urine samples might be the only option in resource-poor settings.

The sixty-sixth World Health Assembly in 2013 endorsed the target of reduction of salt intake by 30% by the year 2025. Monitoring of population salt (sodium) intake is essential for both salt reduction and salt iodization programmes. The level of iodine fortification in salt to control iodine deficiency disorders (IDD) is based on per capita salt (sodium) consumption estimates, and monitoring population sodium intake can be useful for both reducing NCDs and preventing IDD.

The preference of spot urine over 24-hour urine for sodium intake estimation is akin to similar discussions two decades ago for estimation of iodine intake. The case of assessing urinary iodine by 24-hour or spot samples was resolved in favour of spot urinary iodine estimates, considering the requirement of monitoring population level intakes and not individual iodine intakes.

The equations available to estimate sodium intake based on spot urine sodium measurement are population-specific, and are being developed and validated predominantly in western and Japanese populations. Before we conduct surveys to estimate sodium intake based on spot urine sodium measurements in India, we need to validate the different equations in the Indian population or develop new India-specific equations.

Several reviews and validation studies from across the world from diverse field settings have shown that spot urine sodium estimates are a valid approximation of the population sodium intake and are feasible for use in large population-based surveys. The spot urine sample can be easily incorporated into existing programmes/surveys in India at the national and state level (Annual Health Surveys and National Family Health Surveys) to monitor sodium intake and be helpful in formulating strategies for reducing NCDs.
REFERENCES


