

## Letter to the Editor

First published online 5 October 2016

### Urinary sodium-to-potassium ratio: it may be SMART, but is it easy?

Madam

Since the elegant studies of Dahl *et al.* in the early 1970s showed the effects of Na and K combined on the development and severity of salt-induced hypertension<sup>(1)</sup>, the importance of the molar ratio of Na to K (Na:K) in the diet for hypertension management and treatment has gained momentum. Several randomised controlled trials, large epidemiological studies (including the Intersalt study) and systematic reviews have shown that Na:K has a greater association with blood pressure outcomes in hypertensive patients than either dietary Na or K alone<sup>(2–19)</sup>. Na:K may therefore present a target for dietary intervention in hypertensive patients. A recent article in *Public Health Nutrition* by Ge *et al.*<sup>(20)</sup> also showed the potential usefulness of Na:K beyond blood pressure, by indicating an independent association with abdominal obesity.

The WHO dietary recommendation for Na:K of 1·0<sup>(21)</sup> is simple for patients and health professionals to remember. The ease with which patients can achieve this dietary ratio is relatively unknown as many populations' average Na:K appears typically about 3·0 mmol/mmol or more<sup>(11,22,23)</sup>. What is known, is that in the current food environment it is incredibly difficult for patients to meet the individual recommendations for both Na and K simultaneously<sup>(24)</sup>, the combined effect of which is often Na:K below 1·0.

Dietary goals to manage hypertension, like any goals set, need to be SMART: that is, Specific, Measurable, Attainable, Realistic and Timely. The combination of advising patients to increase fruit and vegetable consumption to boost K intakes, alongside readily available literature on lower-salt diets could enable patients to work towards the recommended Na:K. Feedback and tailored advice have been identified as common elements of effective interventions for dietary behaviour change, especially in high-risk groups<sup>(25)</sup>, although objective measures on which to base this feedback and to assess adherence to dietary intervention are often lacking<sup>(26)</sup>. In a previous study, provision of 24 h urinary Na results to hypertensive patients was shown to be more effective for decreasing dietary Na intake over a one-year period than education or advice alone<sup>(27)</sup>. In the case of Na:K, patients' efforts to undertake dietary changes are measurable in urine spot samples<sup>(28,29)</sup> as the target is a molar ratio and not an absolute daily amount. This avoids the challenges inherent in collecting complete 24 h urine samples. While Intersalt showed good correlation between Na:K in a spot

or casual urine sample with the 24 h urine ratio<sup>(29)</sup>, smaller studies suggest that several spot urine samples may be required to achieve the level of accuracy observed with two or more 24 h urine collections<sup>(28,30)</sup>. What is clear, though, is that relevant dietary advice alongside monitoring and feedback has the potential to form an efficient practice for supporting the prescription and efficacy of SMART lifestyle advice.

However, it is important to calculate this seemingly simple ratio correctly. The difference between using millimoles for the calculation (as per the WHO recommendations) and milligrams could mean the incorrect assessment of patient adherence. Even large epidemiological studies seem to have reported milligram ratios only or used the milligram and millimole values interchangeably<sup>(31–34)</sup>, underlining the assumption that the two methods are equivalent; while other studies present the ratio but do not say if it is a milligram or millimole ratio<sup>(35–37)</sup>, leaving readers unsure how to compare data across studies. In an article addressing the feasibility of meeting dietary guidelines for both Na and K independently (at best estimated as 0·5% of the population), Drewnowski and colleagues highlight differences in country-specific recommendations between the USA (<2300 mg Na/d and >4700 mg K/d) and other countries more closely aligned to the WHO recommendations (<2000 mg Na/d and >3510 mg K/d)<sup>(38)</sup>. From these values it becomes apparent that the millimolar (0·83 USA; 0·96 WHO) and milligram (0·49 USA; 0·57 WHO) ratios would also then give very different recommendations both within and between countries. If we consider that the Na targets are even lower in the USA for those at higher risk (<1500 mg Na/d), the ratio becomes even more unattainable as either a molar (0·54) or milligram (0·32) target.

One example of an article that has successfully bridged the millimole/milligram divide is that of Yi *et al.*<sup>(39)</sup> published in *Public Health Nutrition* in 2014. This article evaluates Na:K in a population in New York City, USA clearly citing that adults are assessed against the WHO guideline for optimal Na:K (<1 mmol/mmol, which is equivalent to <0·6 mg/mg). As Yi *et al.* discuss, unless the units of measurement (milligram *v.* millimole) are clearly shown, interpreting the magnitude and relevance of a one-unit change, either in a study or in a patient, becomes difficult. It seems we need to revisit urinary Na:K and further research to support this approach is warranted.

In summary, the molar ratio of Na to K may be a SMART dietary target for hypertensive patients that can be objectively monitored to provide both a measure of adherence and as feedback to support dietary behaviour change, but

the ease with which patients can achieve even the molar target value of Na:K = 1.0 has yet to be shown.

### Acknowledgements

**Financial support:** L.J.W. is supported by an agreement with the University of Wollongong (Australia) and the CDC Foundation with financial support provided by Bloomberg Philanthropies. B.S. is supported by the National Research Foundation (NRF) of South Africa for the duration of her PhD studies. A.E.S. is supported as South African Research Chair (SARChI) by the South African Department of Science and Technology and National Research Foundation, as well as the South African Medical Research Council. These sources of support had no involvement in the writing of this letter. **Conflict of interest:** None declared. **Authorship:** All authors made substantial contributions to the conception, drafting, revision and final approval of the letter. **Ethics of human subject participation:** Not applicable.

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