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Using split urine collections to assess circadian pattern of urinary sodium excretion: a feasibility study

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The 'gold standard' method for assessing sodium intake is 24-hour urinary sodium excretion as around 90% of ingested sodium is excreted in urine[(1)]. Circadian sodium excretion is related to blood pressure regulation[(2)] ; and is typically characterised by maximal daytime excretion followed by minimal night-time excretion. Urine collections (over 24 hours) are usually pooled and thus circadian patterns of excretion are disguised. Split sampling has been used previously; however only using two split urine collections (daytime and night-time)[(2,3)]. There is no published data using more than two split collections. Therefore, the aims of this study were (i) to measure patterns of circadian sodium excretion using four split urine collections across 24-hours (ii) to compare split urinary sodium excretion with diurnal patterns of dietary sodium intake collected using 24-hour recalls.

After approval by TUS Research Ethics Committee, twenty participants (10 male, 10 female) were recruited onto a two-phase study. During phase 1 participants completed a pooled 24- hour urine collection (to familiarise with the burden associated with collecting urine). Phase 2 (7 or 14 days later) involved 4 x 6-hour split urine collections; (8:00–14:00hr, 14:00–20:00hr, 20:00–2:00hr, 2:00–8:00hr). A 24-hour dietary recall was completed after both phases. Urine samples were analysed for sodium, potassium, creatinine levels using Ion Selective Electrode Analysis. Incomplete urine collections were defined as (i) urine volume less than 300 mL per 24 hours or (ii) 24-hour creatinine excretion of <4 mmol or >25 mmol in females or <6 mmol or >30 mmol in males[3] and were excluded.

Three phase 2 participants had incomplete urine samples, (determined by creatinine levels), compared to seven incomplete collections in phase 1 (3 of which had incomplete samples in phase 2). Twenty-four hour urinary sodium excretion and recalled daily sodium intakes were 2812 ± 1071 mg/day and 1923 ± 577mg/d in females *(n = 8),* respectively after phase 2. Corresponding values in males *(n = 9)* were 1962 ± 1207 mg/day and 2239 ± 1469 mg/day. Urinary sodium excretion peaked in the 14:00–20:00hr period totalling 770 ± 223 mg in females (accounting for 32% of total daily sodium excretion). In contrast, urinary sodium excretion was highest in the 20:00–2:00hr period (983 ± 646 mg) in males, (also accounting for 32% of total sodium excretion).

This is the first study to collect more than 2 split urine collections. Although phase 1 was an extra burden, it familiarised participants with urine collection protocol, resulting in only three incomplete urine collections in phase 2. Multiple split sample urine collection facilitates quantitation of the variations in circadian sodium excretion. This method may be used in future studies to assess the effects of changes in sodium intakes on sodium excretion and on 24-hour blood pressure; not previously possible with pooled samples.

References

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