



Spot urinary vitamin C and urinary potassium: novel biomarkers of fruit and vegetable consumption?

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Plasma vitamin C concentration plateaus at higher levels of FV intake⁽¹⁾, therefore spot urinary vitamin C may be a better FV intake biomarker. Potassium (K) is found widely in FV and excreted in urine⁽²⁾. Thus, using data from a randomised FV study, we explored the use of spot urinary vitamin C and K as potential novel biomarkers of FV intake.

Participants were aged 40–65 years and hypertensive (blood pressure of 140–179/90–109 mmHg). Following a one portion FV/day four-week run-in-period, participants were randomised to consume 1, 3 or 6 portions FV/day for eight-weeks. Fasting plasma, spot and 24-hour urine samples were collected pre- and post-intervention. Plasma vitamin C was measured using a fluorimetric method on an automated Cobas Fara centrifugal analyser. Urinary vitamin C was measured on a BMG FLUOstar Optima plate reader. Urinary K was measured on the ion selective electrode module of a Cobas analyser.

A total of 117 subjects completed the 12-week study. Across the intervention groups plasma vitamin C increased, but plateaued between 3 and 6 portions/d. In contrast, spot and 24-hour urinary vitamin C increased as FV intake increased. No statistically significant differences were found between the three groups in spot and 24-hour urinary K excretion.

Urinary vitamin C, but not urinary K excretion, may be a potential biomarker of FV intake.

			1 portions/d (n _{max} = 29)	3 portions/d (n _{max} = 38)	6 portions/d (n _{max} = 38)	p-value
Plasma vitamin C (µmol/l) ¹	Baseline	Mean	23.7	25.7	27.9	0.62
		IQR	15.5, 34.3	20.9, 36.7	19.2, 45.0	
	Change 8 wk	Mean	1.09	1.51	1.52	0.06
		95% CI	0.90, 1.32	1.20, 1.91	1.26, 1.83	
Spot urinary vitamin C (µmol/l) ¹	Baseline	Mean	141.17	144.95	107.98	0.193
		IQR	97.55, 211.60	90.12, 194.65	68.41, 182.86	
	Change 8 wk	Mean	0.93 ^a	1.22 ^{ab}	1.64 ^b	0.001
		95% CI	0.78, 1.10	0.97, 1.52	1.24, 2.19	
24-hour urinary vitamin C (µmol/l) ¹	Baseline	Mean	143.97	102.56	107.13	0.112
		IQR	109.35, 178.72	78.36, 145.36	71.45, 180.03	
	Change 8 wk	Mean	0.95 ^a	1.17 ^a	2.23 ^b	<0.001
		95% CI	0.81, 1.12	0.91, 1.50	1.63, 3.03	
Spot urinary potassium (mmol/l) ²	Baseline	Mean	67.2	63.5	61.7	0.71
		SD	40.2	35.4	43.0	
	Change 8 wk	Mean	-16.1	2.8	-2.1	0.428
		95% CI	-30.2, -1.9	-17.5, 23.1	-20.3, 16.0	
24-hour urinary potassium (mmol/l) ²	Baseline	Mean	36.6	42.6	38.5	0.901
		SD	17.1	20.7	21.2	
	Change 8 wk	Mean	-5.1	-3.7	-1.2	0.604
		95% CI	-13.6, 3.4	-17.8, 10.5	-10.3, 7.9	

¹Variables were logarithmically transformed. All baseline values are geometric mean (IQR), and all change values are geometric mean (95% CIs) of the ratio of the week 8 to baseline value. ²All baseline values are mean (SD), and all changes mean (95% CI). Changes were calculated as week 8 – baseline; changes were compared between groups using one way analysis of variance with a test for linear trend. Superscripted letters indicate homogeneous subsets.

1. Jenab M, Slimani N, Bictash M, Ferrari P, Bingham SA (2009) *Hum Genet* **125**, 507–525.
 2. Bingham SA (2002) *Public Health Nutr* **5**(6A), 821–827.