

Summer Meeting, 28 June–1 July 2010, Nutrition and health: cell to community

## Beetroot juice consumption reduced blood pressure in normotensive individuals in an acute dose-response study

T. W. George, N. Kaffa and J. A. Lovegrove

*Hugh Sinclair Unit of Human Nutrition, Department of Food and Nutritional Sciences and the Institute for Cardiovascular and Metabolic Research (ICMR), The University of Reading, Whiteknights, PO Box 226, Reading, Berks RG6 6AP, UK*

Elevated blood pressure (BP) is a leading preventable cause of morbidity and mortality and an established independent risk factor for CVD and stroke. Fruit and vegetable-rich diets have been shown to reduce systolic blood pressure (SBP) in hypertensive subjects<sup>(1,2)</sup>. Green leafy vegetables conferred the strongest protection<sup>(1)</sup>. These contain high concentrations of nitrate that can act as a substrate for the endogenous formation of the potent vasodilator nitric oxide after consumption<sup>(3)</sup>. Beetroot juice (BJ) is also rich in nitrate and has been shown to lower SBP by 10 mmHg in normotensive individuals when given as a 500 ml dose<sup>(4)</sup>.

The present study investigated the dose-response effects of BJ on 24 h ambulatory blood pressure (ABP). Twenty-five normotensive volunteers (18 males and 7 females), aged 18–64 years, consumed 3 doses of BJ (100, 250 and 500 ml) and a water/no BJ control in a single-blind, randomized and controlled crossover study. Low-nitrate mineral water was used to match the volume in all drinks to 500 ml. ABP was determined every 15 min for 1 h pre- and 4 h post-drink consumption, every 30 min for a further 9 h and hourly overnight. Urine was collected at 0, 2, 4, 6 and 24 h after BJ consumption. The subjects followed a low-nitrate diet for 48 h and consumed standardised low-nitrate meals the night before and during the study day.

SBP was significantly reduced 2–3 h post ingestion by 6.73, 6.69 and 9.82 mmHg for 100, 250 and 500 ml BJ, respectively. Incremental area under the curve (IAUC) for SBP and diastolic BP (DBP) were significantly lower 0–240 min post ingestion ( $P < 0.001$ ) after all BJ doses with SBP remaining lower up to 780 min ( $P < 0.001$ ). Urinary nitrate/nitrite was significantly higher than no BJ for all doses ( $P < 0.001$ ) and remained significantly raised up to 24 h post consumption of 500 ml BJ ( $P = 0.004$ ). Urinary nitrate/nitrite IAUC was significantly and negatively correlated with IAUC for SBP and DBP ( $r^2 = -0.331$ ,  $P = 0.001$  and  $r^2 = -0.240$ ,  $P = 0.017$ , respectively). Urine antioxidant potential significantly increased after 500 ml BJ at 240 min post ingestion.

Overall, the study showed that BJ ingestion significantly, and in a near dose-dependent manner, lowered BP and increased urine nitrate/nitrite levels in normotensive subjects. These findings support the existing evidence for a beneficial effect of nitrate-rich BJ in lowering BP, which may contribute to the cardioprotective effects of vegetable-rich diets.

1. Joshipura KJ, Hu FB, Manson JE *et al.* (2001) The effect of fruit and vegetable intake on risk for coronary heart disease. *Ann Intern Med* **134**, 1106–1114.
2. Sacks FM, Svetkey LP, Vollmer WM *et al.* (2001) Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. *N Eng J Med* **344**, 3–10.
3. Lundberg JO & Govoni M (2004) Inorganic nitrate is a possible source for systemic generation of nitric oxide. *Free Radic Biol Med* **37**, 395–400.
4. Webb AJ, Patel N, Loukogeorgakis S *et al.* (2008) Acute blood pressure lowering, vasoprotective, and antiplatelet properties of dietary nitrate via bioconversion to nitrite. *Hypertension* **51**, 784–790.