

Dietary nitrate supplementation reduces the O₂ cost of walking and running: a placebo-controlled study

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Abstract

Dietary supplementation with beetroot juice (BR) has been shown to reduce resting blood pressure and the O₂ cost of sub-maximal exercise and to increase the tolerance to high-intensity cycling. We tested the hypothesis that the physiological effects of BR were consequent to its high nitrate content, per se, and not to the presence of other potentially bioactive compounds. We investigated changes in blood pressure, mitochondrial oxidative capacity (Q_{max}), and the physiological responses to walking, moderate-intensity running and severe-intensity running following dietary supplementation with BR and nitrate-depleted beetroot juice (PL). Following control (non-supplemented) tests, nine healthy, physically-active male subjects were assigned in a randomized, double-blind, cross-over design to receive BR (0.5 L·d⁻¹; containing ~6.2 mmol of nitrate) and PL (0.5 L·d⁻¹; containing ~0.003 mmol of nitrate) for six days. Subjects completed treadmill exercise tests on days four and five, and knee-extension exercise tests for the estimation of Q_{max} (using ³¹P-MRS) on day six of the supplementation periods. Relative to PL, BR elevated plasma [nitrite] (PL: 183±119 vs. BR: 373±211 nM, P<0.05) and reduced systolic blood pressure (PL: 129±9 vs. BR: 124±10 mmHg; P<0.01). Q_{max} was not different between PL and BR (PL: 0.93±0.05 vs. BR: 1.05±0.22 mM·s⁻¹). The O₂ cost of walking (PL: 0.87±0.12 vs. BR: 0.70±0.10 L·min⁻¹; P<0.01), moderate-intensity running (PL: 2.26±0.27 vs. BR: 2.10±0.28 L·min⁻¹; P<0.01), and severe-intensity running (End-exercise V_{O₂}; PL: 3.77±0.57 vs. BR: 3.50±0.62 L·min⁻¹; P<0.01) was reduced by BR, and time-to-exhaustion during severe-intensity running was increased by 15% (PL: 7.6±1.5 vs. BR: 8.7±1.8 min; P<0.01). In contrast, relative to control, nitrate-depleted beetroot juice did not alter plasma [nitrite], blood pressure or the physiological responses to exercise. These results indicate that the positive effects of 6 days of BR supplementation on the physiological responses to exercise can be ascribed to the high nitrate content per se.