

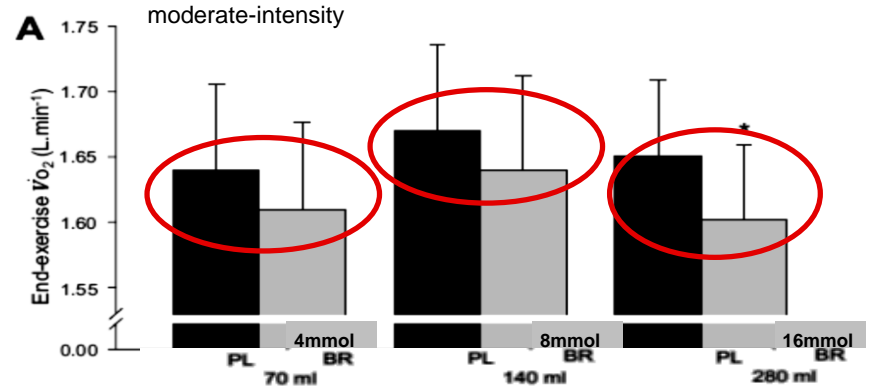


THE INFLUENCE OF EQUIMOLAR NITRATE DOSES FROM BEETROOT JUICE AND SODIUM NITRATE ON UPPER AND LOWER BODY EXERCISE

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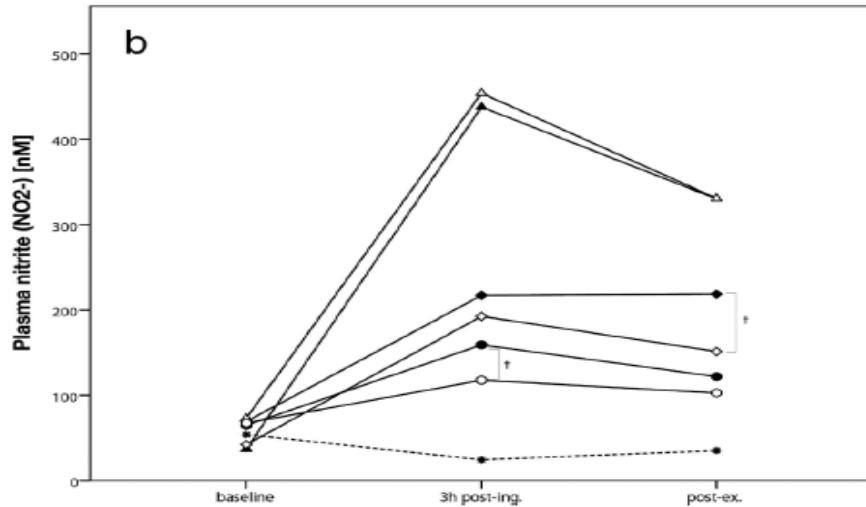
Introduction

- Green leafy and root vegetables Hord et al., 2009
- Stepwise reduction: Lundberg et al., 2008
 $\text{NO}_3^- \rightarrow \text{NO}_2^- \rightarrow \text{NO}$
- Peak blood levels after 2.5 - 3 h Wylie et al., 2013



Wylie et al. 2013

Introduction



(Flueck et al. 2016)

Beetroot juice vs. sodium nitrate

- Lower VO_2 at 80% VO_{2max} with 6mmol beetroot juice compared to placebo
- Lower VO_2 at 80% VO_{2max} compared to 6 mmol sodium nitrate
- Beetroot juice more effective reducing exercise-induced muscle damage compared to sodium nitrate

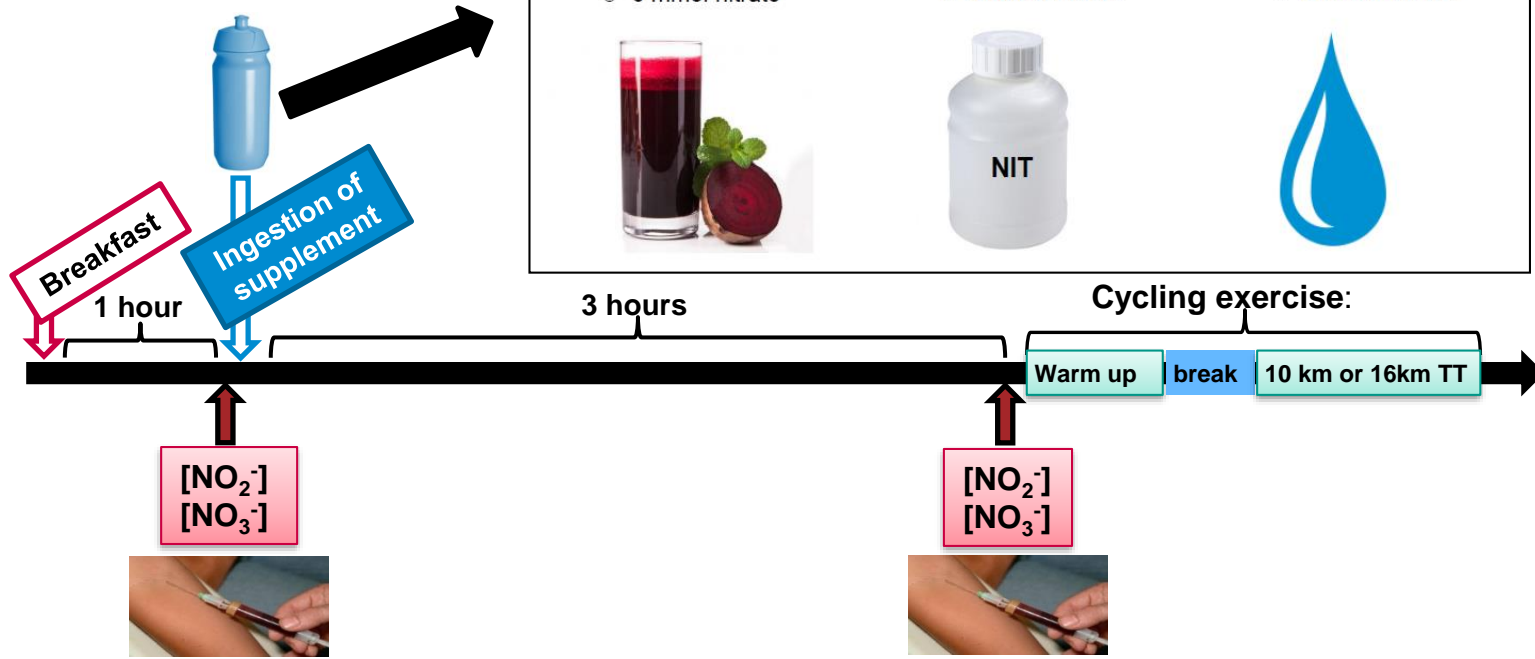
(Flueck et al. 2016)

(Clifford et al. 2017)

Different outcome in time trial performance when 6mmol beetroot juice vs. 6mmol sodium nitrate is ingested?

Methods: Study

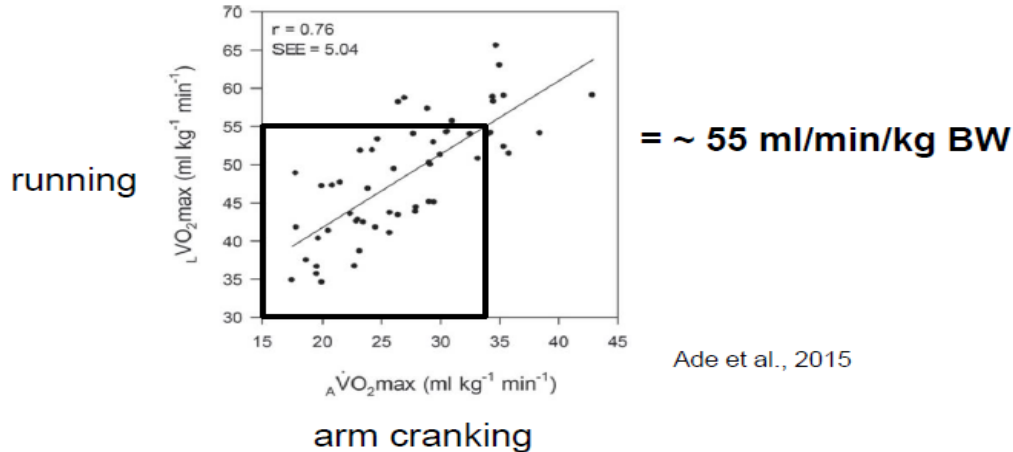
- Placebo-controlled, randomised



Results: Able-bodied participants

Group	N	age [y]	height [cm]	weight [kg]	$\dot{V}O_{2peak}$ [ml/min/kg BW]	P_{max} [W]	Training [units/week]	Training [h/week]
Handcycling	14	28 ± 7	183 ± 5	82 ± 9	33.9 ± 4.2	152 ± 20	4 ± 2	6 ± 3
Cycling	15	31 ± 8	182 ± 7	76 ± 7	59.1 ± 5.2	410 ± 47	4 ± 2	7 ± 3

Data is presented as mean ± SD.



Ade et al., 2015

Results: Wheelchair athletes

■ Paracyclists:

ID	Age [year]	Height [cm]	Body Mass [kg]	VO _{2peak} [ml/min/kg]	PO _{max} [W]	Lesion Level	Category
1	42	188	66	41.5	200	Th5	MH3
2	34	169	72	29.7	144	L4	MH4
3	29	170	47	42.8	151	C4	MH2
4	54	178	75	49.7	222	Th12	MH5
5	32	173	60	36.9	180	Th3	MH3
6	61	178	61	45.9	208	Th4	MH3
7	40	165	64	44.8	220	Th10	MH4
8	35	190	76	17.3	98	C6	MH1
40 ± 11		176 ± 9	65 ± 9	38.6 ± 10.5	178 ± 44		

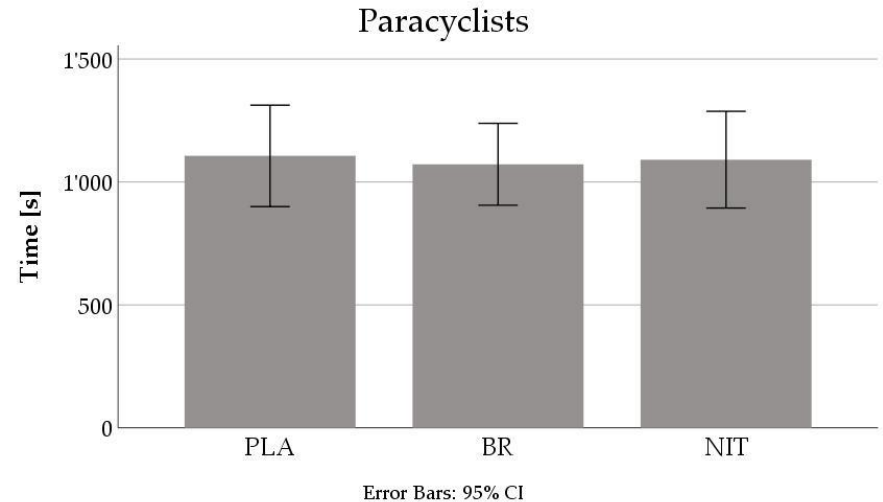
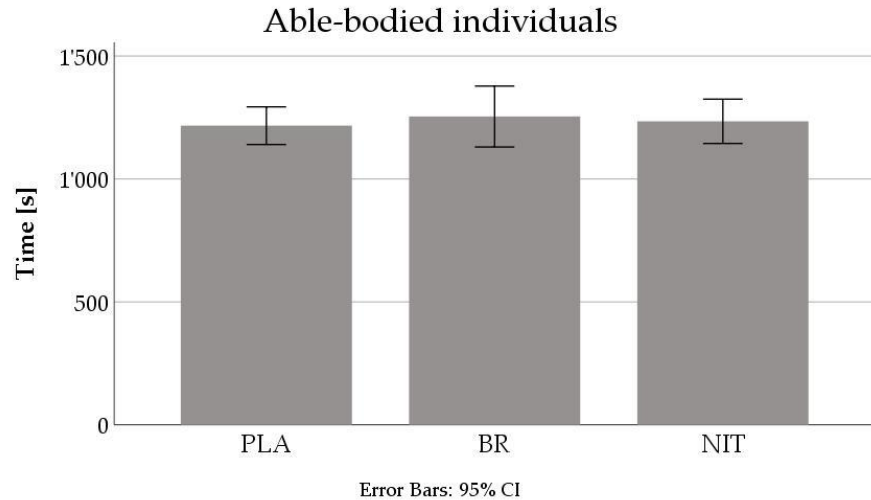
Note: Data presented as mean ± standard deviation, PO_{max} = maximal power output in the ramp test, VO_{2peak} = peak oxygen uptake measured during the ramp test.

Results: Plasma NO₃⁻/NO₂⁻ Concentrations

		Able-Bodied Individuals		Paracyclists	
		Pre	Post	Pre	Post
Plasma [NO ₃ ⁻] in uM	PLA	68.5 ± 8.4	67.9 ± 8.6	37.9 ± 18.8	38.1 ± 18.9
	NIT	64.8 ± 10.9	278.7 ± 154.9 * [†]	36.8 ± 19.9	85.9 ± 73.2 * [†]
	BR	63.5 ± 8.9	273.7 ± 82.8 * [†]	38.8 ± 17.9	125.8 ± 99.3 * [†]
Plasma [NO ₂ ⁻] in nM	PLA	44.7 ± 21.5	41.2 ± 28.7	66.9 ± 27.9	92.3 ± 109.9
	NIT	56.7 ± 22.6	141.2 ± 75.7 * [†]	57.7 ± 11.6	136.7 ± 69.6 * [†]
	BR	61.5 ± 53.8	121.2 ± 57.3 * [†]	108.7 ± 134.3 [†]	263.3 ± 159.2 * [†]

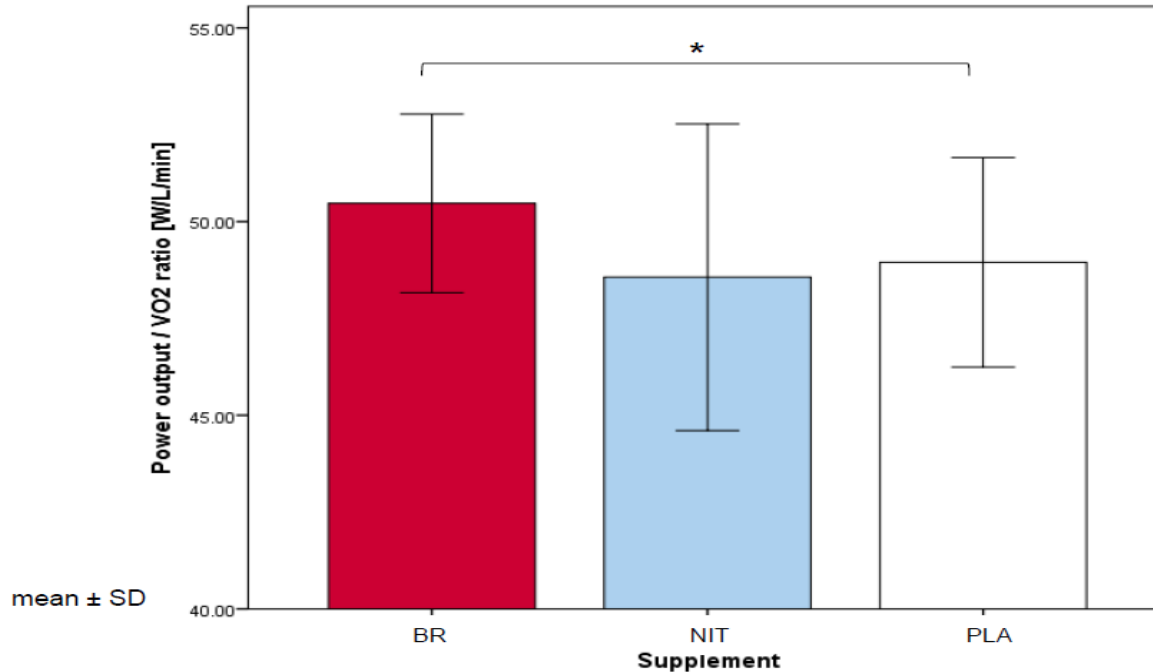
Note: PLA = placebo, NIT = sodium nitrate, BR = beetroot juice, * significant difference ($p < 0.05$) compared to pre ingestion, [†] = significant difference ($p < 0.05$) to PLA, pre = before ingestion of the supplement, post = 3 h after ingestion of the supplement.

Results: Performance (paracycling TT)



No significant influence on time to complete TT in cycling (data not shown here)

Results: Power output to VO_2 ratio



- Significant difference between BR and PLA (+3%) (handcycling)
- No significant difference in power output to VO_2 ratio in cycling group

Discussion

- PO / VO₂ ratio increased by 2 % during kayaking after 4.8 mmol BR.
→ No improvement of performance. Peeling et al., 2015



- PO / VO₂ ratio increased by 7 % during cycling after 6.2 mmol BR.
→ Improved 16-km cycling TT performance. Lansley et al., 2011

- Leg vs. upper body muscles?
- Dosage?
- Duration/intensity of exercise?

Take Home Message

- No significant difference in TT performance after ingestion of BR, NIT, PLC
- Handcycling (AB): higher power output to VO_2 ratio in BR compared to NIT and PLC, no difference in cycling
- More individuals with a benefit in cycling compared to handcycling
- Dosage?
- Exercise duration and intensity?
- Arm vs. leg muscles? Beetroot juice vs. nitrate?

→ Further studies are needed!!