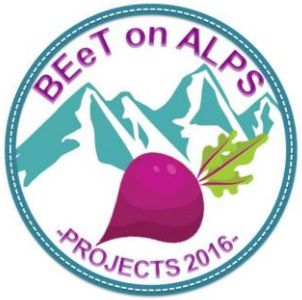

7° International Congress
MOUNTAIN, SPORT & HEALTH
Rovereto, 9-10 November 2017

"BEet On Alps": Dietary Nitrate Supplementation improves Skeletal Muscle Oxidative Metabolism during Prolonged Exposure to Hypobaric Hypoxia

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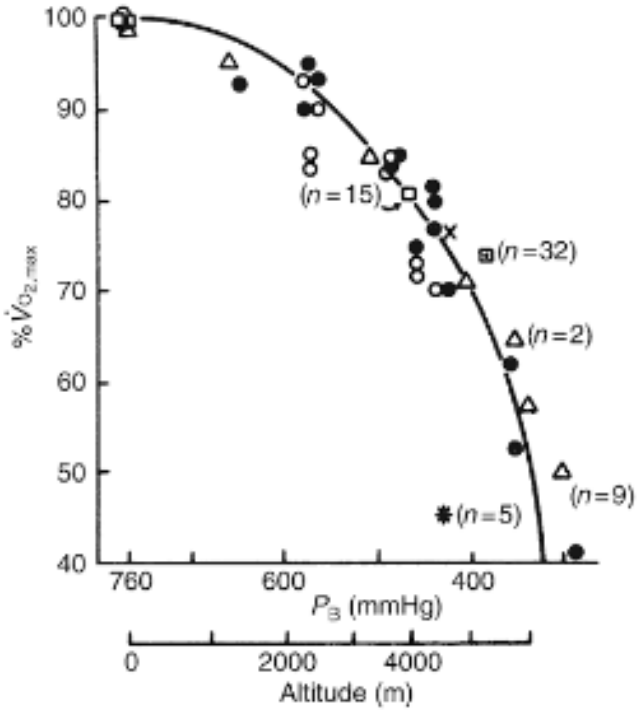
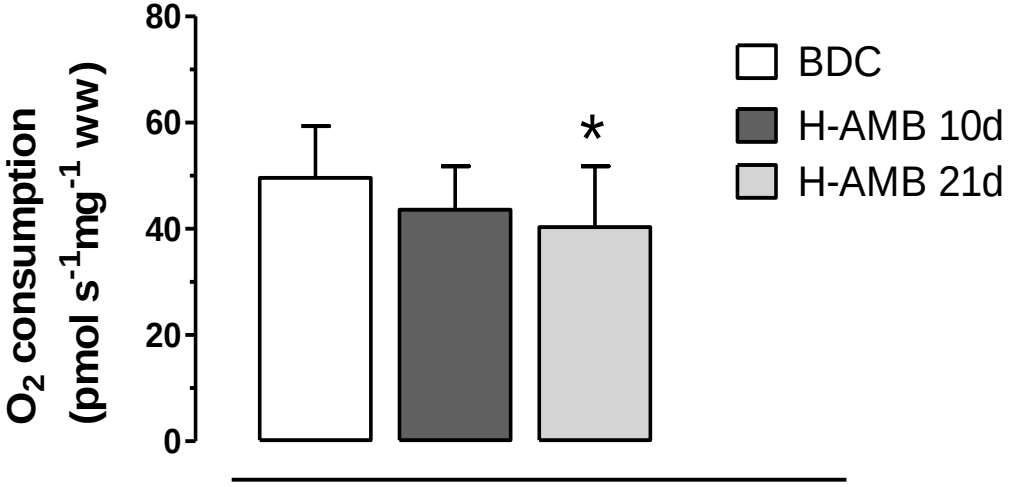
OXIDATIVE METABOLISM & CHRONIC HYPOXIA



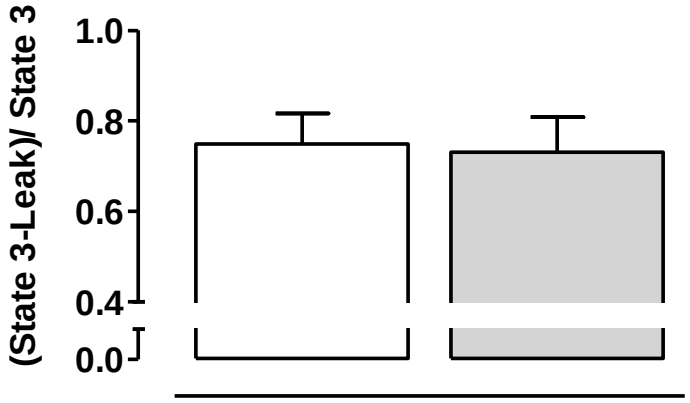
(Cerretelli., 1980)

Isolated VL muscle fibers 4,000m altitude

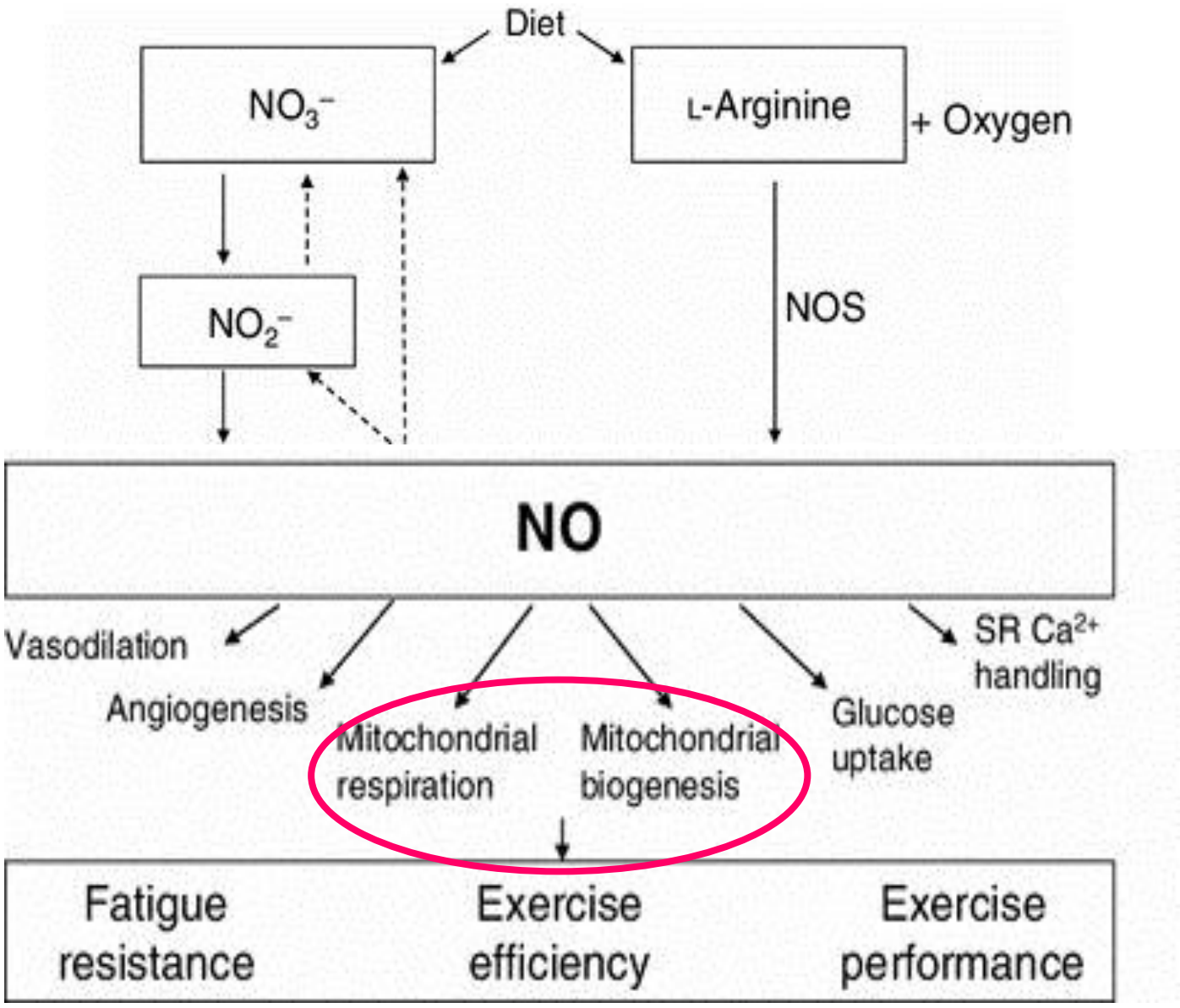
Max ADP-stimulated resp



Oxidative phosphorylation coupling



(Salvadego et al., 2016-17)


Diet
NO_3^-
L-Arginine
+ Oxygen
NO_2^-
NOS
NO
Vasodilation
Angiogenesis
Mitochondrial respiration
Mitochondrial biogenesis
Glucose uptake
SR Ca^{2+} handling
Fatigue resistance
Exercise efficiency
Exercise performance

(Jones 2014)

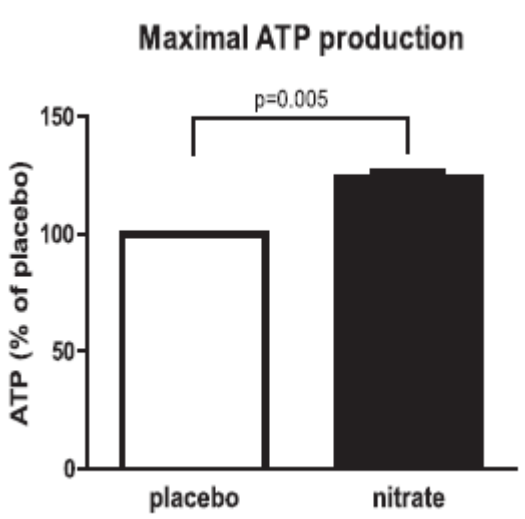
DIETARY NITRATE & OXIDATIVE METABOLISM

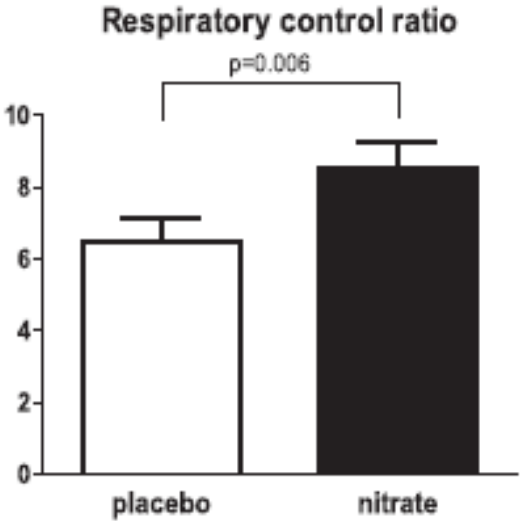
NORMOXIA

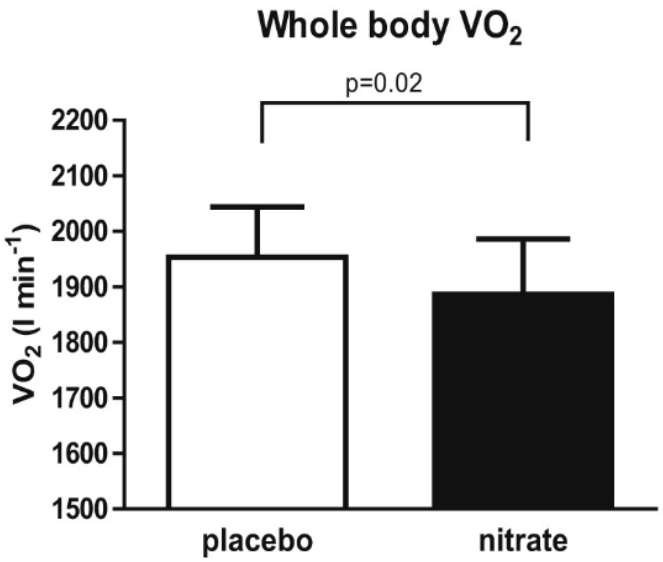
Isolated VL muscle fibers

Young healthy subjects
3 d dietary $NaNO_3$

Whole body







Larsen et al., 2011

IMPROVED MITOCHONDRIAL EFFICIENCY AND REDUCED O_2 COST OF EXERCISE

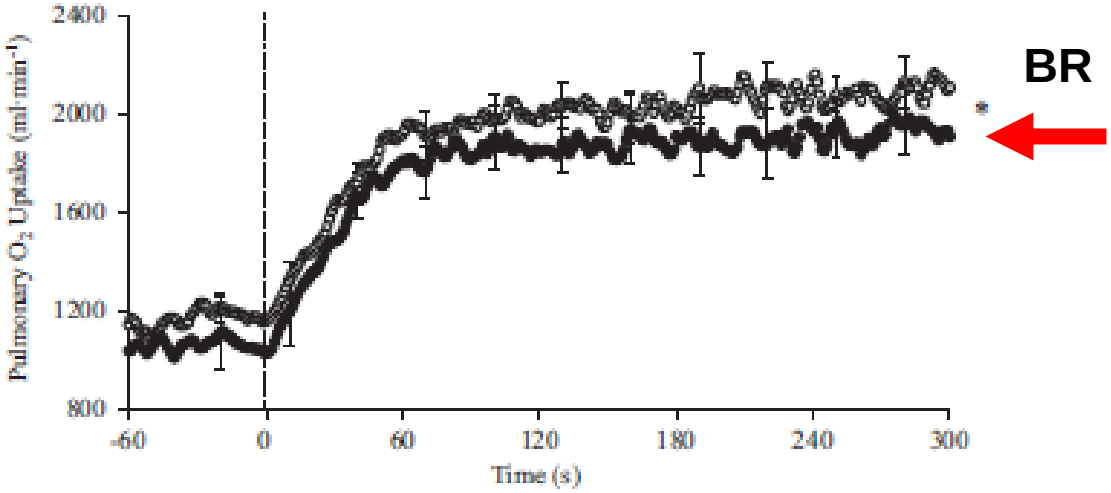
DIETARY NITRATE & OXIDATIVE METABOLISM

ACUTE HYPOXIA

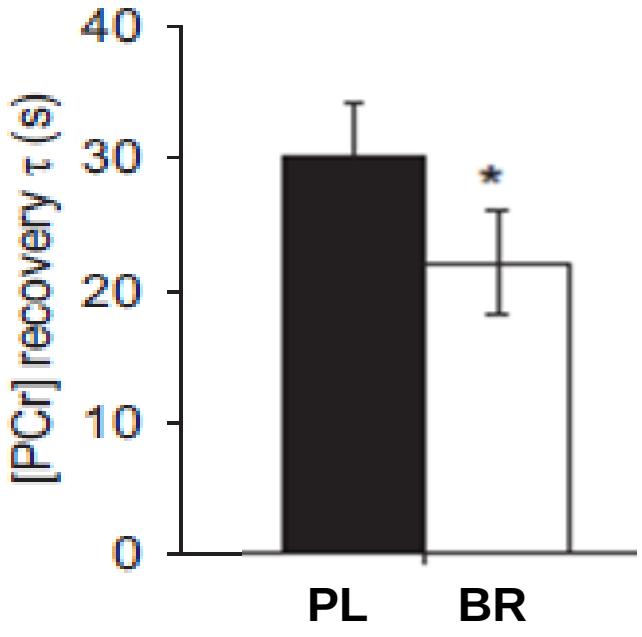
CWR<GET

F_IO_2 0.13

3d BR supplementation
8.4 mmol nitrate/day



(Kelly et al., 2014)



** p<0.05*

(Vanhatalo et al., 2014)

COMBINED CHRONIC HYPOBARIC HYPOXIA and DIETARY NITRATE SUPPLEMENTATION

14 (11 males 3 females) healthy physically active subjects

Age (Years)	Mass (Kg)	Height (m)	BMI (Kg*m^{-2})	$\dot{V}O_2peak$ (mL* kg^{-1}*min^{-1})
28 ±6	70.8 ±11.8	1.76 ±0.09	22.7 ±2.4	45.5 ± 9.0

SITE(S) OF METABOLIC EFFECT?

Whole body oxidative function *in vivo*

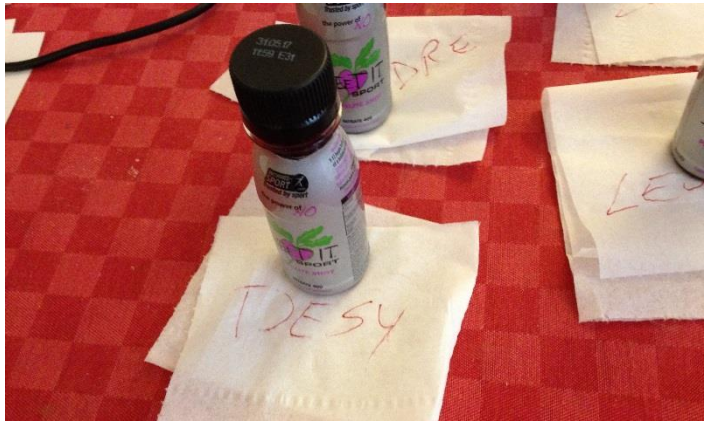
- Pulmonary O_2 uptake

Muscle oxidative function *in vivo*

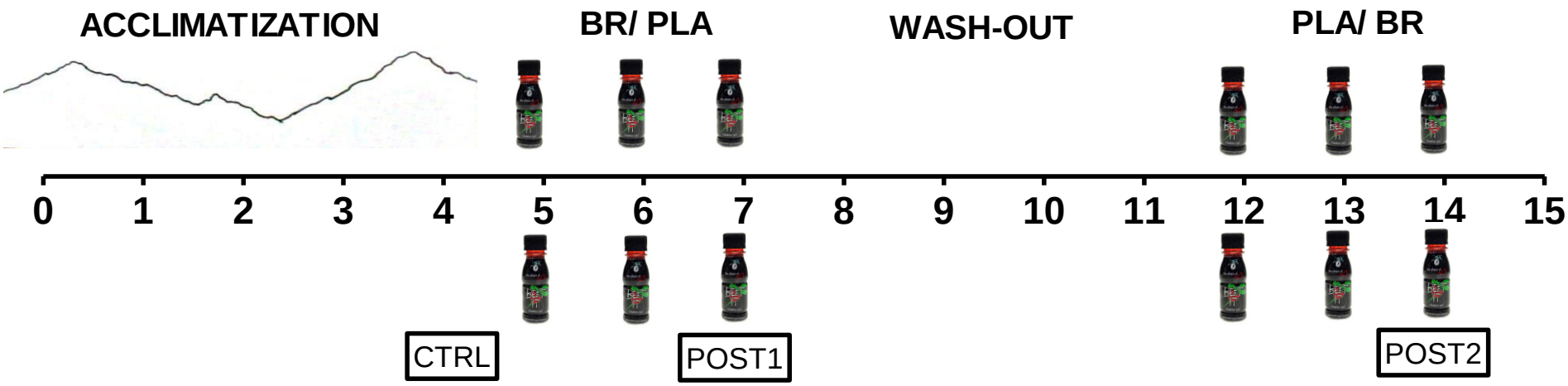
- Recovery kinetics of *gastrocnemius muscle* oxygen consumption (by Near-Infrared Spectroscopy)

COMBINED CHRONIC HYPOBARIC HYPOXIA and DIETARY NITRATE SUPPLEMENTATION

Rifugio Casati 3,269m altitude



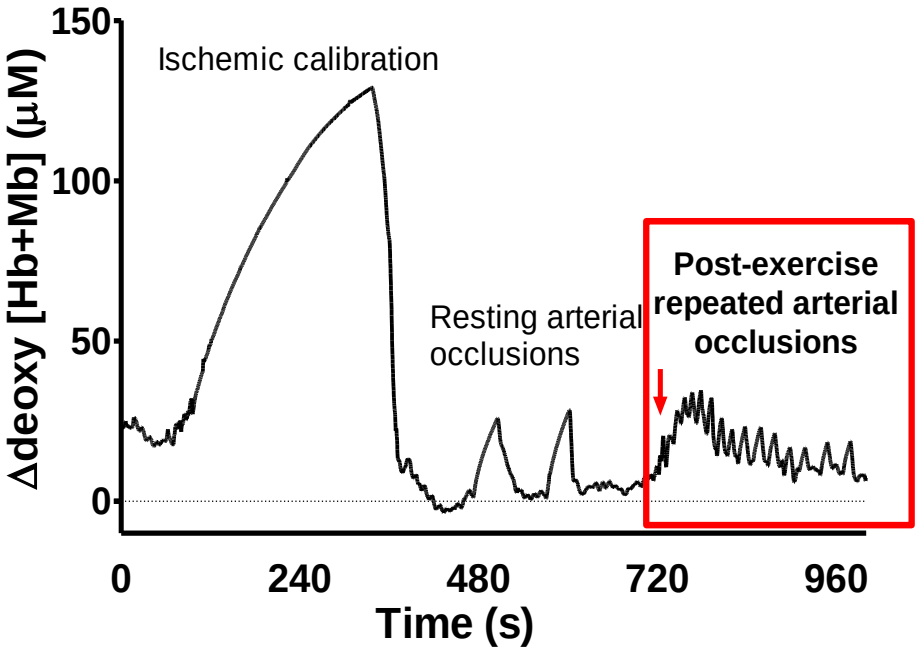
2x70mL/day Beetroot juice



8.4 mmol nitrate/day (BR) Nitrate-depleted juice (PLA)

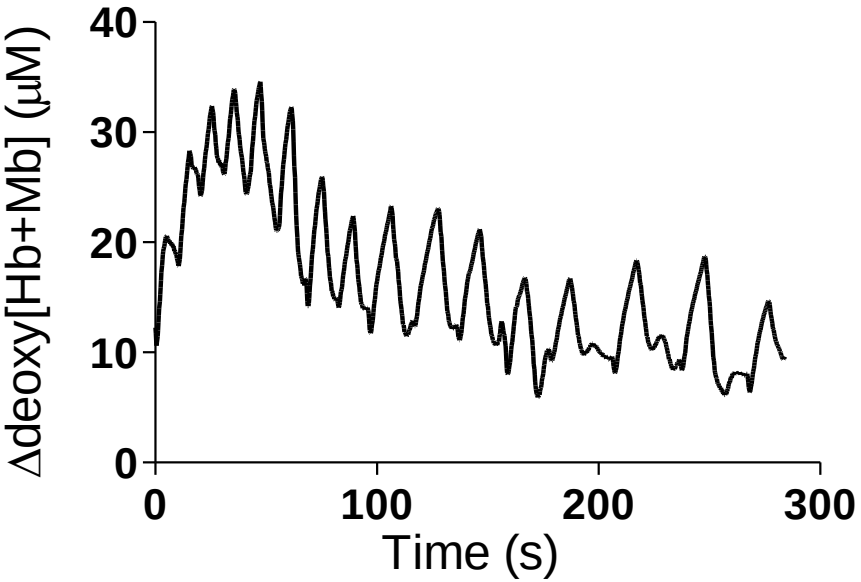
REPEATED MEASURES CROSS-OVER STUDY

Muscle oxidative function *in vivo by NIRS*



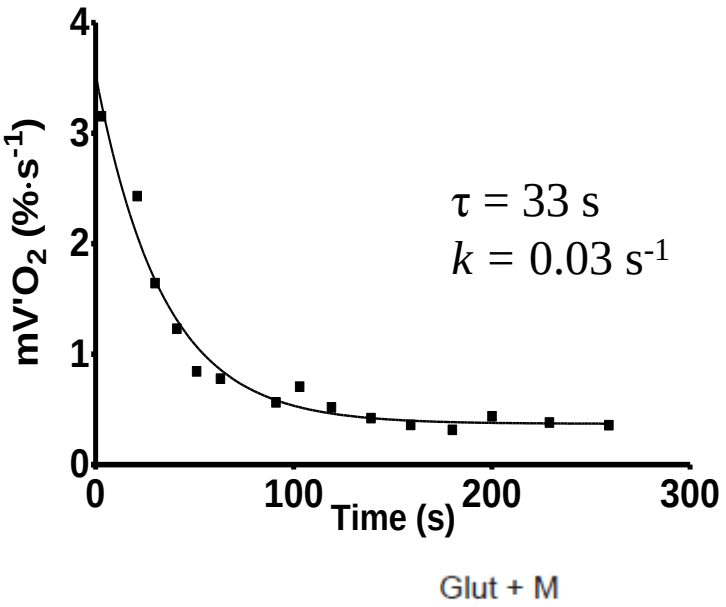
Medial portion of the gastrocnemius muscle

Repeated, transient arterial occlusions after a 15 s bout of plantar-flexion exercise

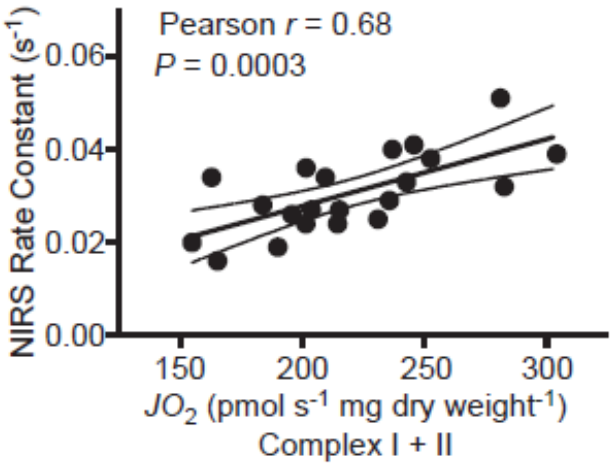


Changes in deoxy [Hb+Mb] following intermittent arterial occlusions at rest (Post exercise mV'O_2)

RECOVERY KINETICS of mV'O_2

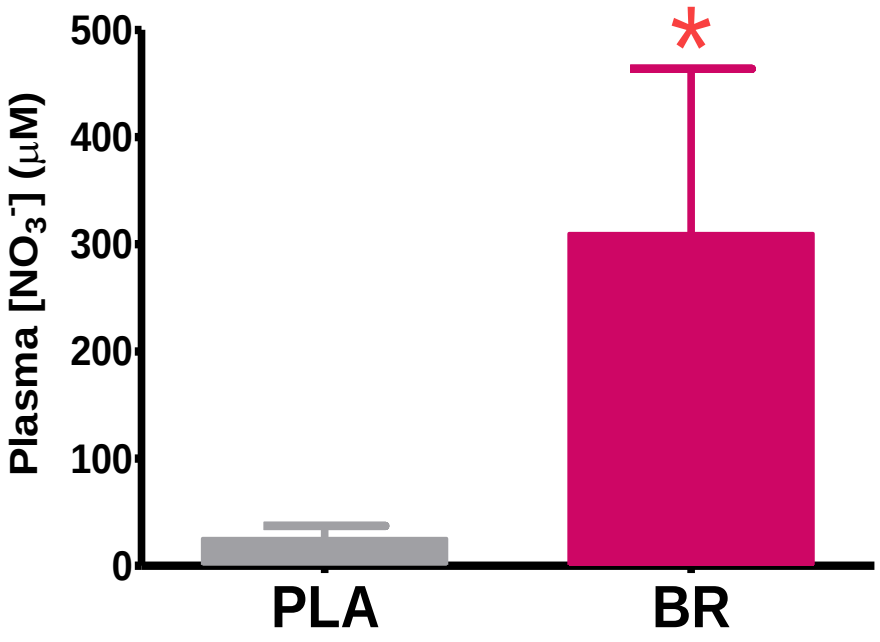


Post exercise mV'O_2 are fit to an exponential function

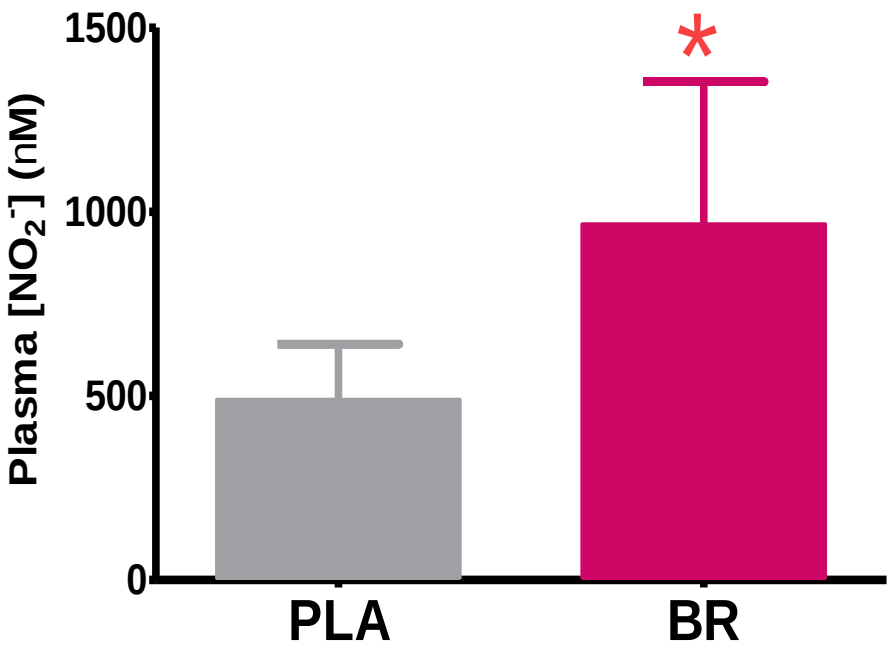


The rate constant of the kinetics is an index of muscle mitochondrial respiratory capacity
(Ryan et al. 2013)

Plasma [Nitrate]

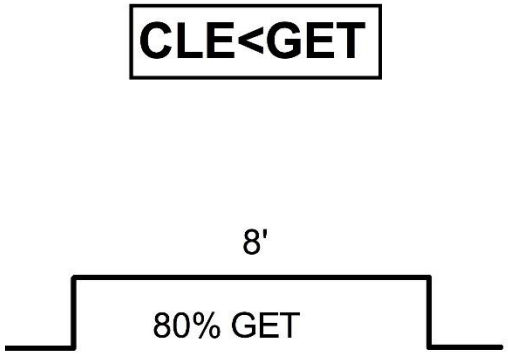


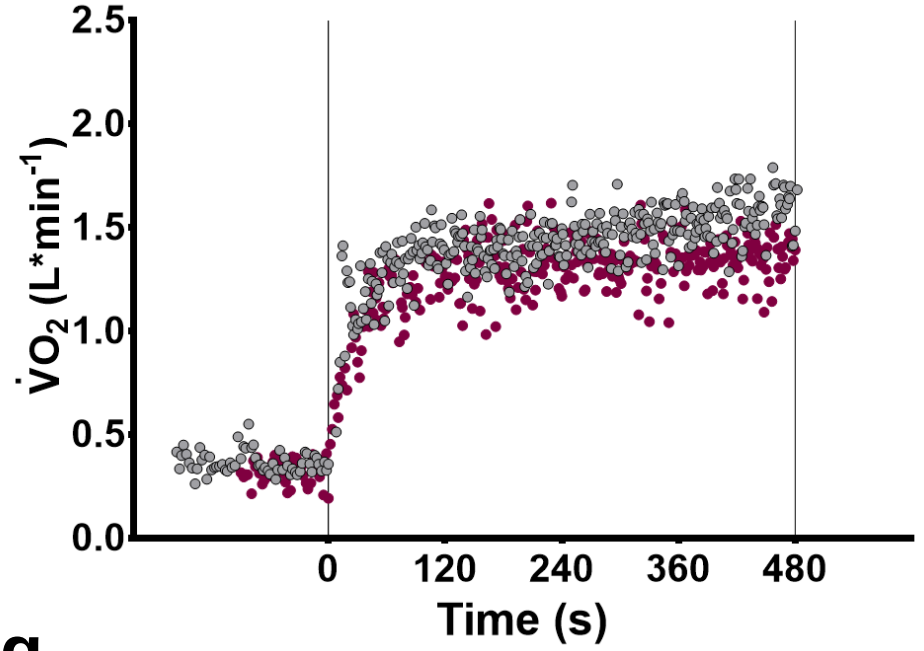
Plasma [Nitrite]



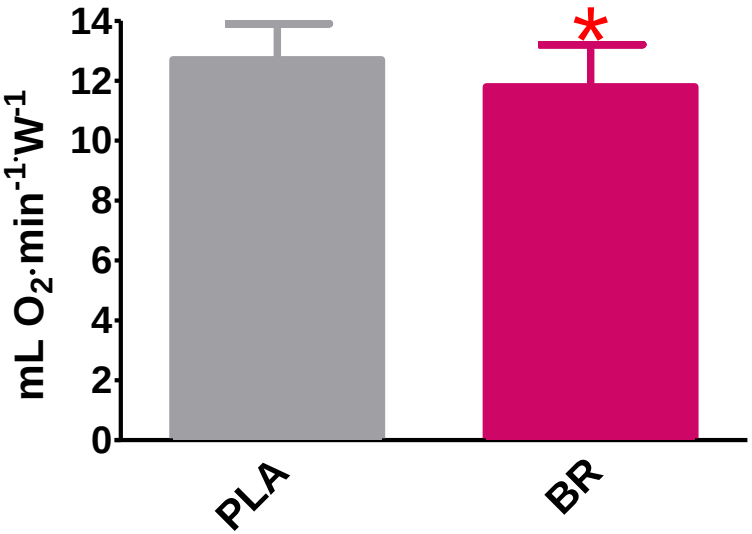
** p<0.05*

Whole body oxidative function



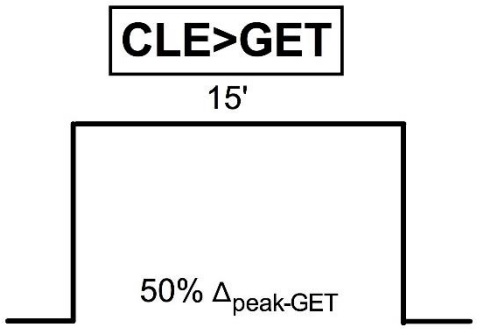


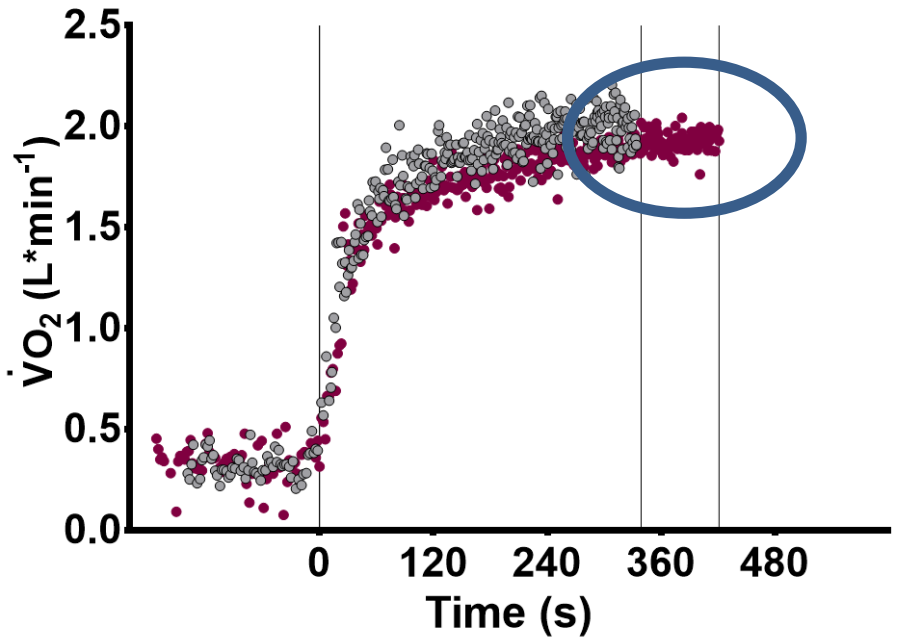
O_2 cost of cycling



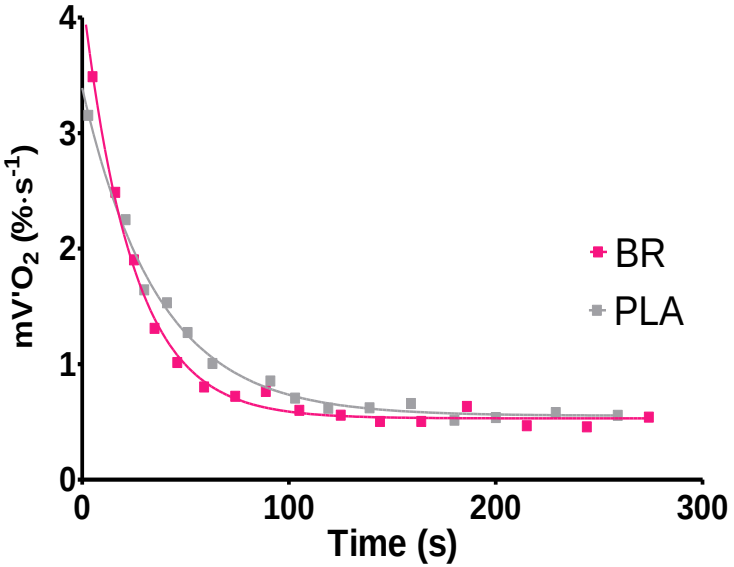
** p<0.05*

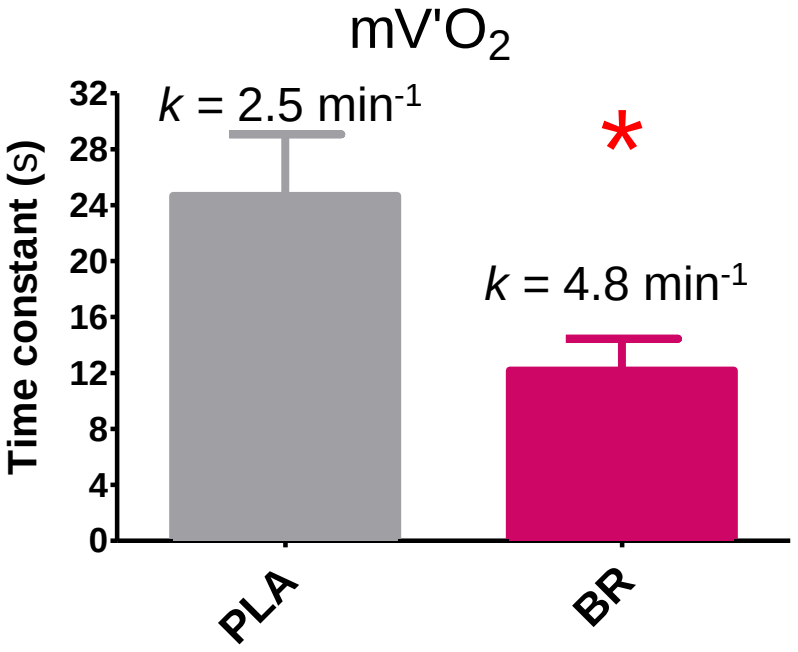
Whole body oxidative function

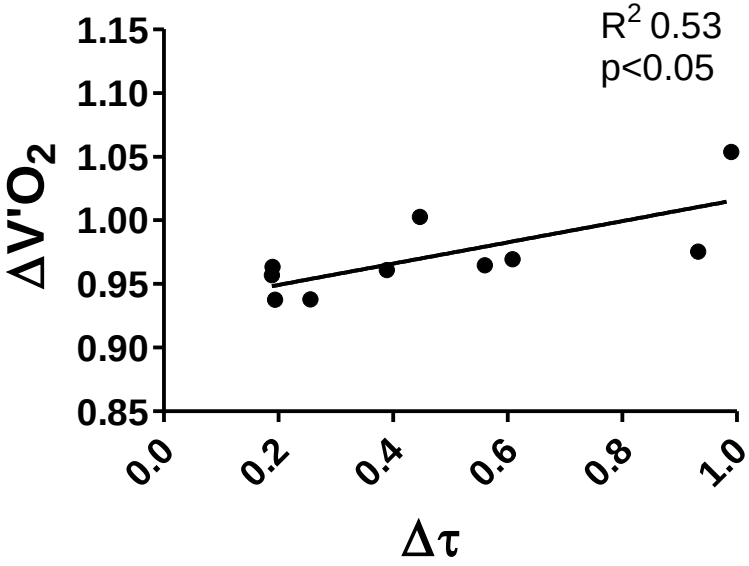




Muscle oxidative function *in vivo*







* *p<0.05*

Conclusion

Under chronic hypoxia:

- **3d BR supplementation markedly INCREASED PLASMA [NO_3^-] and [NO_2^-]**
- **3d BR supplementation REDUCED the O_2 COST of CYCLING**
- **3d BR supplementation ACCELERATED the RECOVERY KINETICS OF MUSCLE V'O_2 after short-term exercise**

AN IMPROVED MITOCHONDRIAL FUNCTION MAY BE RESPONSIBLE FOR THE IMPROVED EXERCISE EFFICIENCY

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GRUPPO ORTLES-CEVEDALE
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IBFM

UNIVERSITAS STUDIORUM UTINENSIS