New Zealand science – More evidence for blackcurrant assisting the recovery from exercise oxidative stress and enhancing immunity

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Sports – what can blackcurrant offer?

NUTRITION SUPPLEMENT	RATIONALE	RECOMMENDATION BASED ON CURRENT EVIDENCE
Carbohydrate	Maintains blood glucose during exercise, lowers release of stress hormones; counters negative immune changes post-exercise	Recommended; up to 60 g per hour of heavy exertion
Fruit & vegetable extracts rich in polyphenols & flavonoids	Act by modulating exercise induced inflammation; also decreases oxidative stress.	Recommended, but most research focused on oxidative stress
Quercetin	Strong anti-inflammatory, anti-oxidative, and anti-pathogenic effects; increase in mitochondrial biogenesis and performance.	Recommended when mixed with other flavonoids and nutrients
Bovine colostrums	Mix of immune, growth, and hormonal factors improve immune function and lower illness risk	Mixed results, and more data needed
Probiotics	Improve intestinal microbial flora, and thereby enhance gut and systemic immune function	Mixed results, and more data needed
β-glucan	Receptors found on intestinal wall immune cells interact with β-glucan improving innate immunity.	Mixed results: mushroom β-glucan may effective, but more data needed
Vitamin E	Quenches exercise-induced reactive oxygen species (ROS) and augments immunity	Not recommended; may be pro-oxidative and pro-inflammatory
Vitamin C	Quenches ROS and augments immunity	Not recommended; not consistently different from placebo

‘Enhancing the natural benefits of exercise’

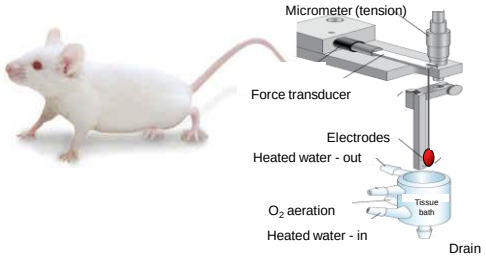
Sports performance & recovery – approach

Cultivar Composition

Cell Screening

Human Trials

Ex Vivo Functionality



Focus on 'biomarkers' after exercise

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Physical Activity/Exercise Models

Rowing	Repeat quadriceps squats	Repeat leg extensions	High intensity training
			
30 mins, 80% max heart rate	**4 sets of 10 repeats – to failure -**	**3 sets of 100 repeats Resist arm**	**All out for 60 sec Ramping up repeats x3 /week over 4 weeks**
Oxidative Stress	***Muscle damage***	***Muscle damage***	***Fatigue/endurance/training***

A platform for human-intervention ‘evaluation’

- R.D. Hurst, et al., (2009) Blueberry fruit polyphenolics suppress oxidative stress-induced skeletal muscle cell damage in vitro, *Mol. Nutr. Food Res*. 53, 1-11.
- M.A. Skinner, et al., (2007) Health benefits of ZESPRI GOLD Kiwifruit: effects on muscle performance, muscle fatigue and immune responses. *Proc. Nutr Soc of NZ*, vol 31, 49-59.
- B. Schrage, et al., (2010) Evaluating the health benefits of fruits for physical fitness: A research platform. *J. Berry Res.* 1, 35-45.
- K.A. Lyall, et al., (2009) Short-term blackcurrant extract consumption modulates exercise-induced oxidative stress and lipopolysaccharide-stimulated inflammatory responses, *Am. J. Physiol. Regul. Integr. Comp. Physiol.* 297, R70-81.
- S.M. Hurst & R.D. Hurst (Sept 2013) Anthocyanins, innate immunity and exercise. *In: Anthocyanins in Health & Disease.* Taylor C. Wallace (Ed), CRC Press.
- Y. McLeay, et al., (2012) Effect of New Zealand blueberry consumption on recovery from eccentric exercise-induced muscle damage. *J. Int. Soc. Sports Nutri.*
- D.C. Nieman, et al., (2015) Post-exercise skeletal muscle glycogen related to plasma cytokines and muscle IL-6 protein content, but not muscle cytokine mRNA expression. *Front Nutr.* Sep 9;2:27. doi: 10.3389/fnut.2015.00027.

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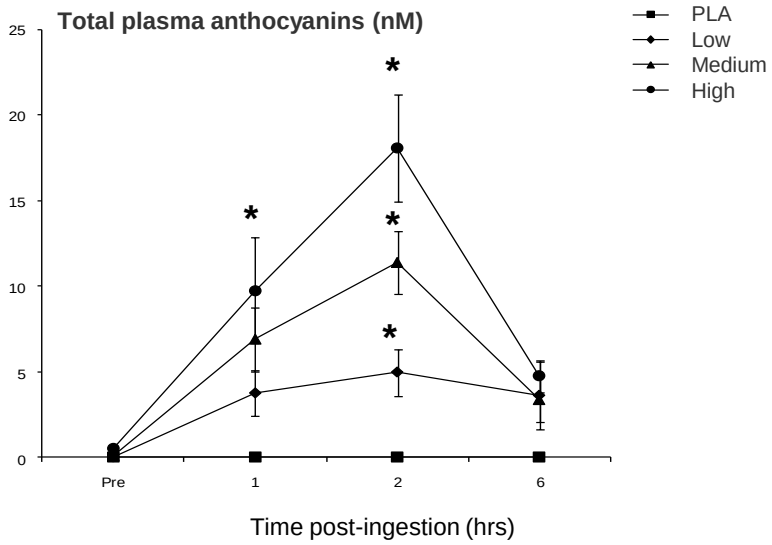
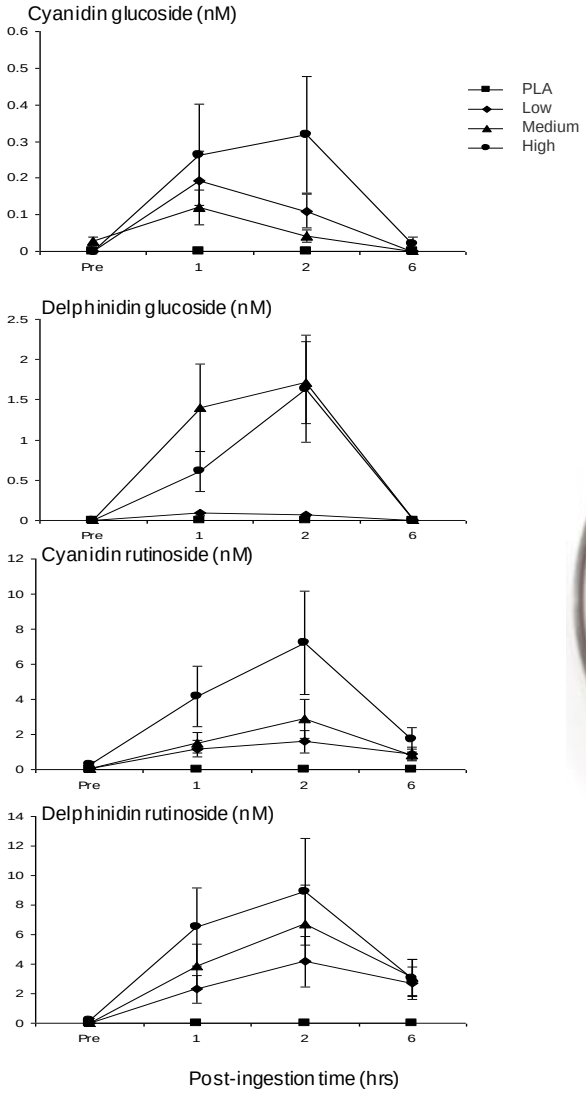
Blackcurrant anthocyanin bioavailability – which dose ?





- Optimum dose determined
- Peak post consumption determined

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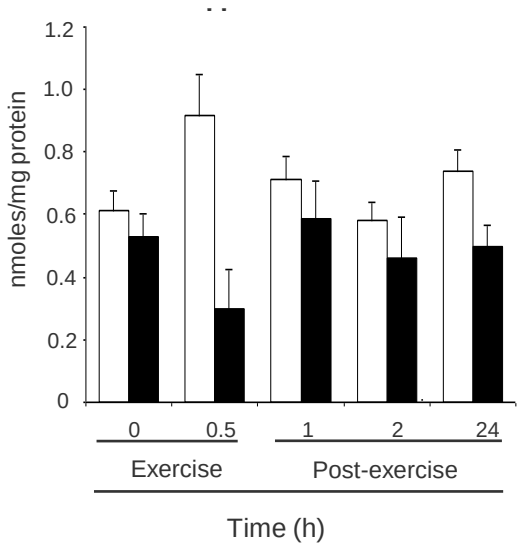
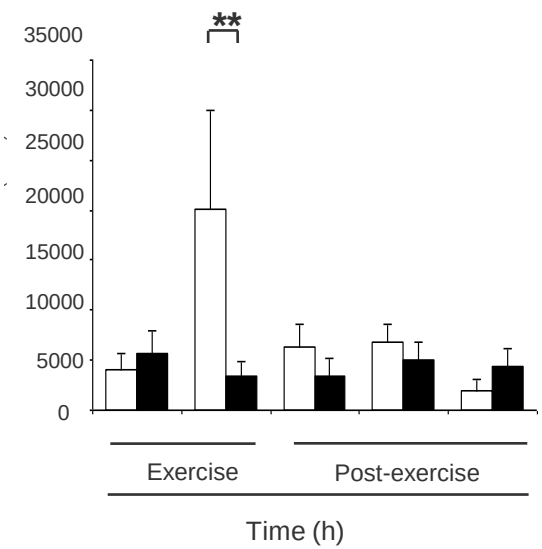
Human exercise – blackcurrant Oxidative stress model

- N=8 volunteers
- Double-blind, cross-over
- 30 min rowing exercise at 80% max ♥ rate
- 240 mg total anthocyanin

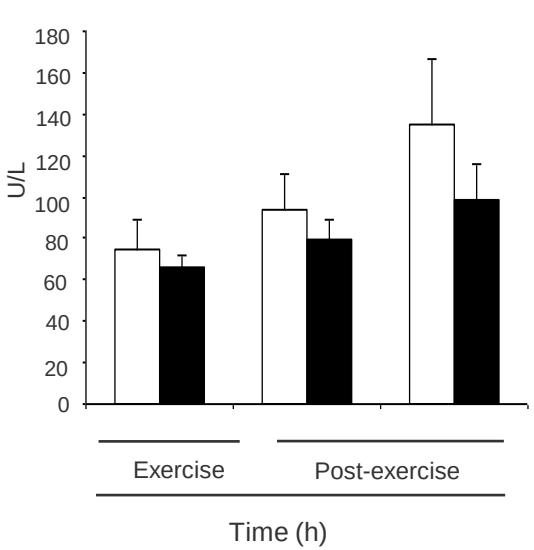
Protein carbonyls



Oxidative capacity



CK activity



Blackcurrant modulated exercise-induced oxidative stress and muscle damage

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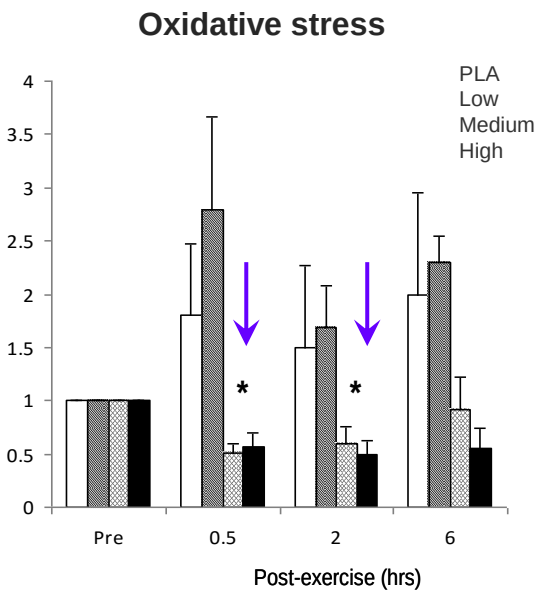
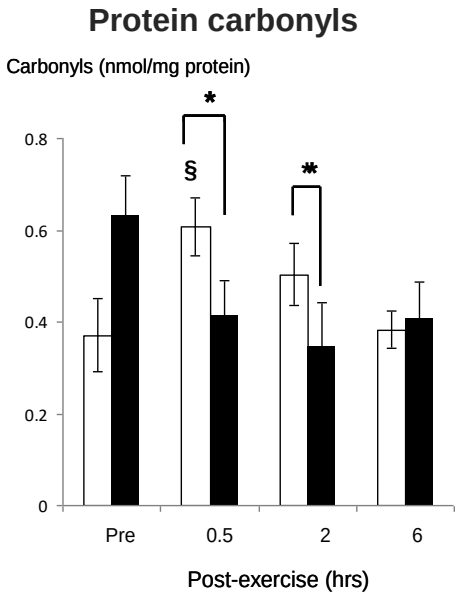
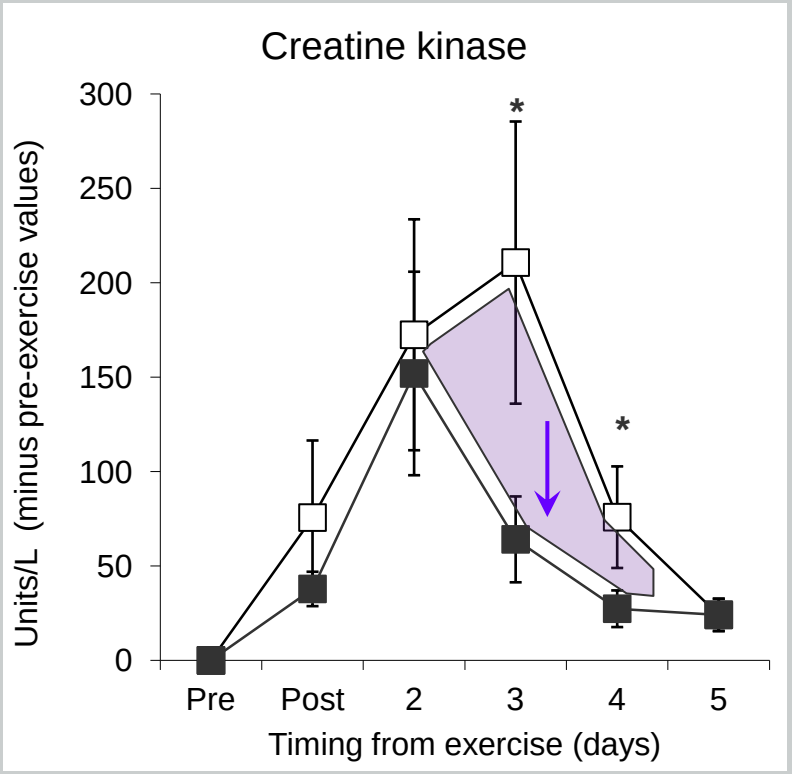
Exercise oxidative stress/glycation – Dose

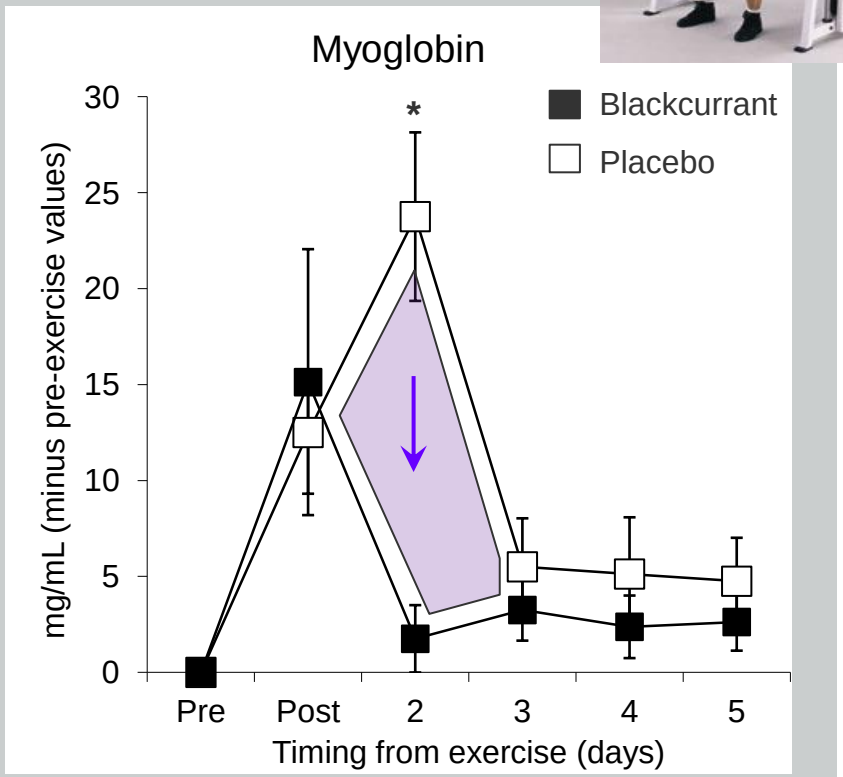




Minimum effective single 'one shot' dose

NZ blackcurrants reduce markers of muscle damage





Muscle damage prevention by blackcurrant – long term action

S.M. Hurst & R.D. Hurst (2013) Anthocyanins, innate immunity and exercise. *In: Anthocyanins in Health & Disease.* Taylor C. Wallace (Ed), CRC Press.

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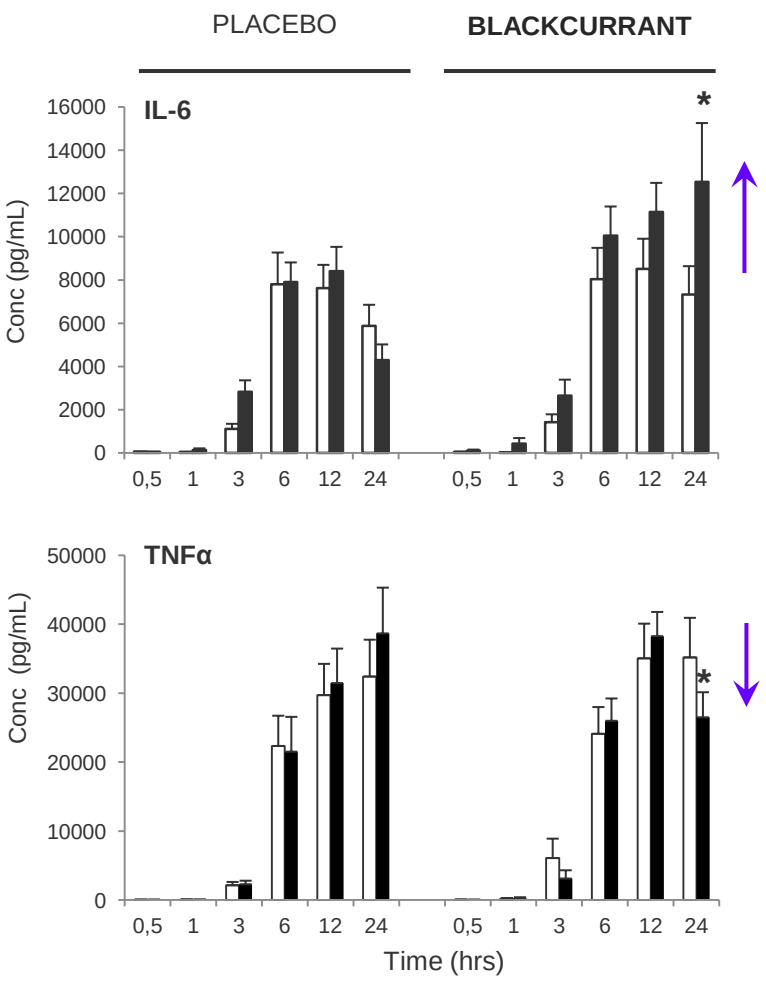
Human exercise – Blackcurrant - Immunity



Earlier resolution
- Quicker repair

S.M. Hurst & R.D. Hurst (2013) Anthocyanins, innate immunity and exercise. *In: Anthocyanins in Health & Disease.* Taylor C. Wallace (Ed), CRC Press.

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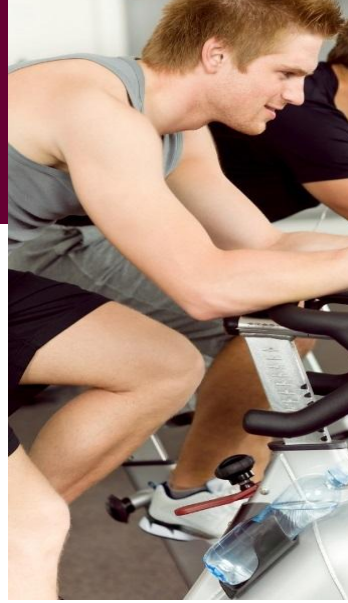
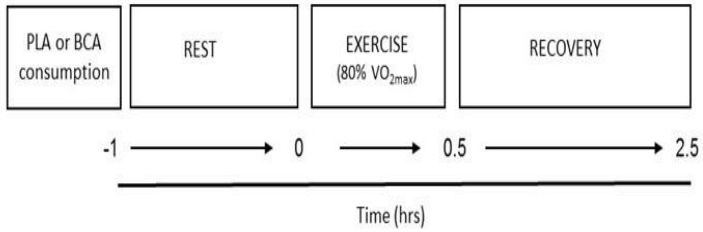
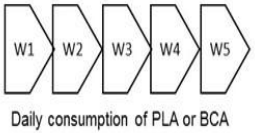
5 Weeks of consumption



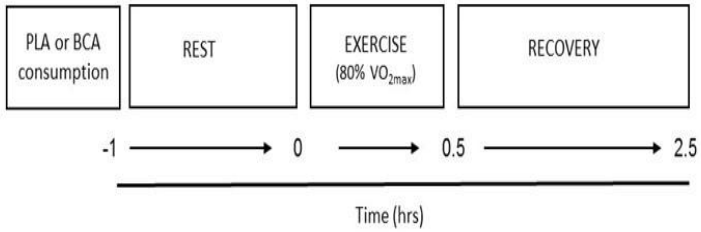
- **N=13 volunteers**
- **Anthocyanins (medium) daily for 5 weeks**

Pre-Exercise trial (day 1, week 1)





Post-Exercise trial (day1, week 6)



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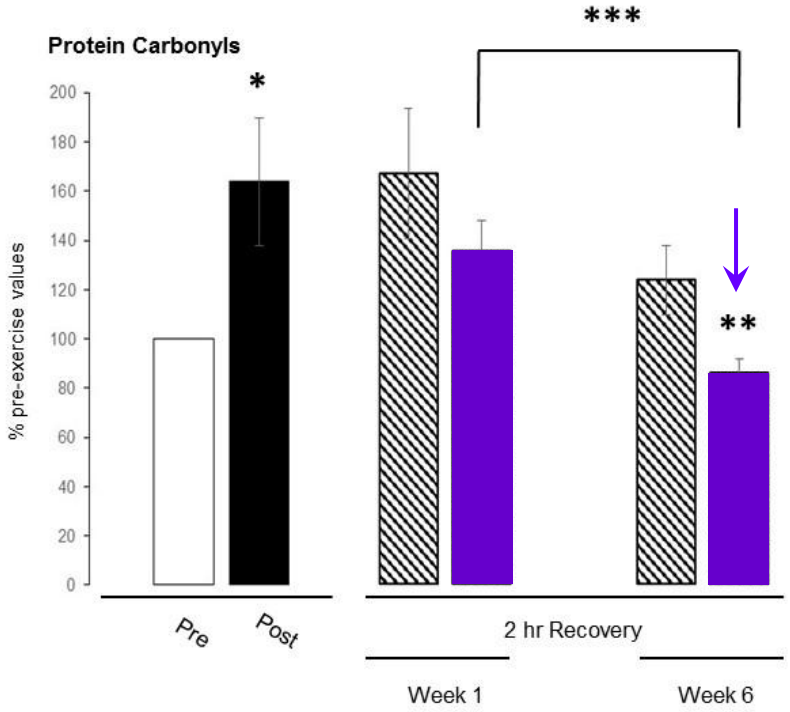
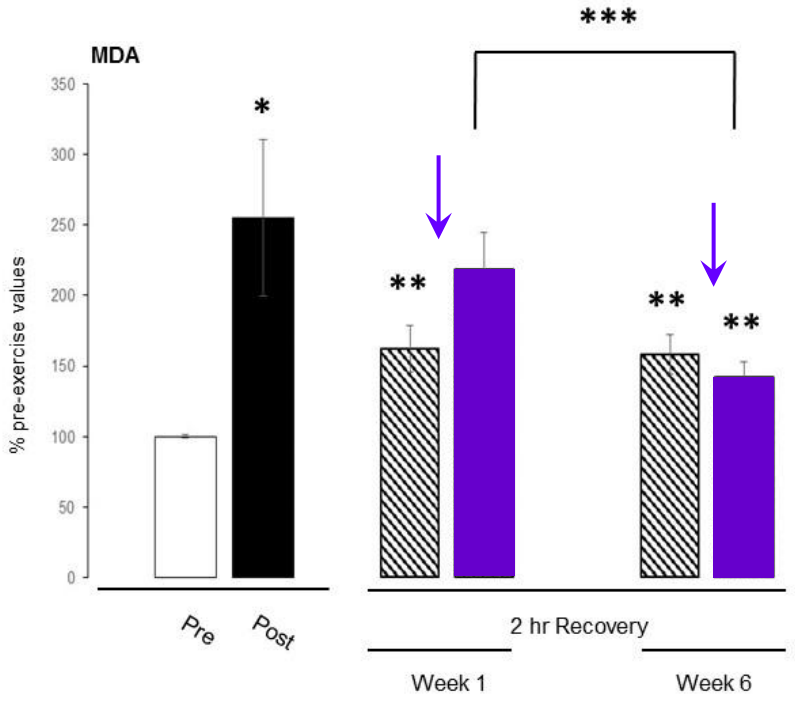
5 weeks - Effects on oxidative stress

40 % improvement





Blackcurrant reduced exercise-oxidative stress
Effect increased with long-term consumption

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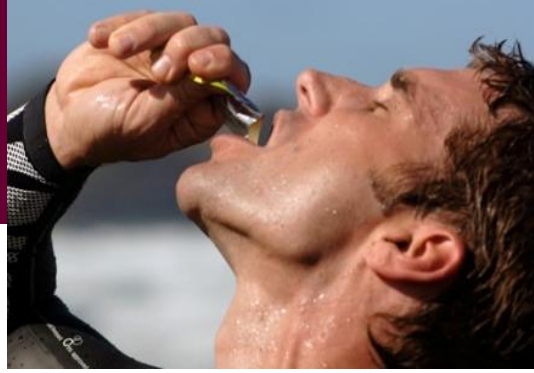
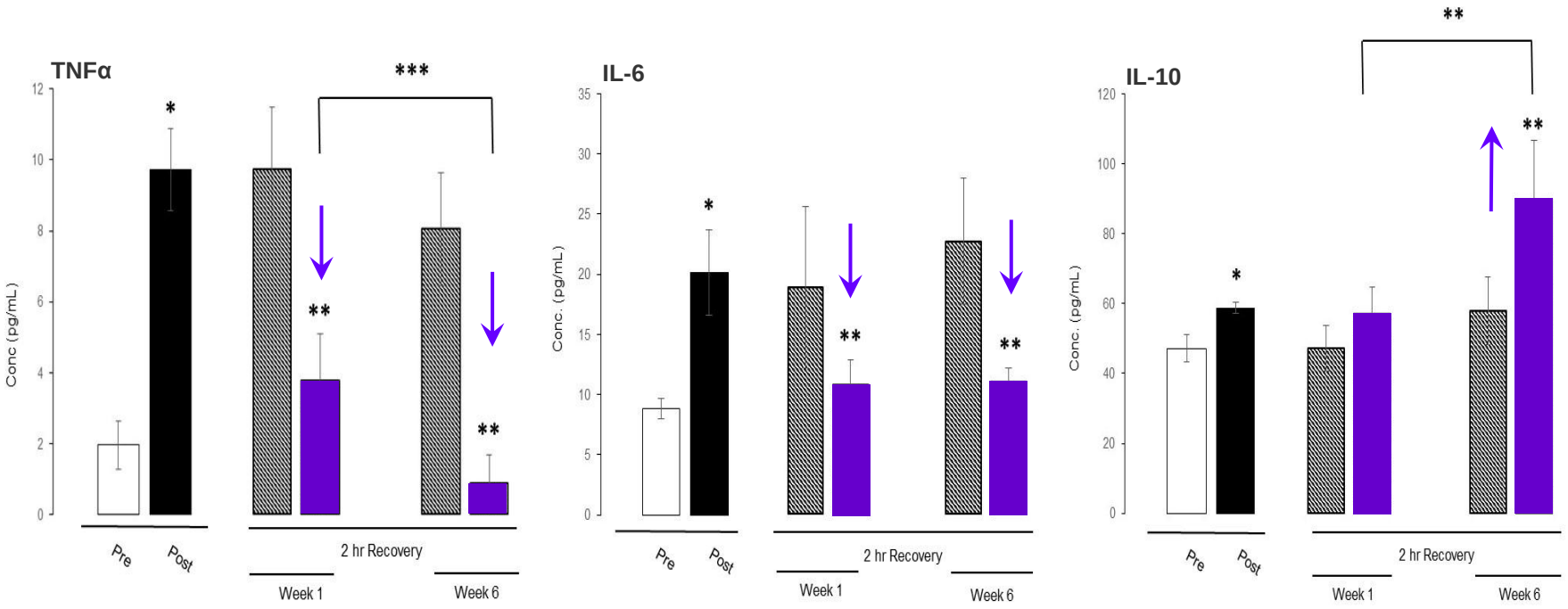
5 weeks - Effects on inflammation





Blackcurrant modulated exercise-induced inflammation
Effect increased after long-term consumption

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Summary - Why is this important?

- Good evidence for ‘assisting the natural benefits of exercise & sports’ from New Zealand blackcurrant
- Good evidence of functionality - dose, timing, long-term benefits, bioactives, likely mode of action

Benefits backed by Science

Testimonials Sujon Freeze Dried Blackcurrant Powder

"It is unbelievable how much it helps with aerobic recovery."

Alex Jordon, New Zealand nationally ranked sprinter

"I recover faster and can train harder the next day".

Mika Vukona,
Professional basket ball player
and Tall Black (NZ National Team)

"Sujon powder is a perfect boost"

Anneke Jenkins,
Top ranked, NZ Professional Triathlete

"Gives us a competitive edge and has made a big difference to our training and recovery"

Courteney Lowe and Emma Grant, Professional NZ cyclists and members of professional USA cycling team

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