

Title New Zealand Blackcurrant Anthocyanins for Performance, Recovery and Health: What Dietitians and Sports Nutritionists Need to Know

Item Type	Article (Version of Record)
UoW Affiliated Authors	Cook, Matthew
Full Citation	Cook, Matthew (2026) New Zealand Blackcurrant Anthocyanins for Performance, Recovery and Health: What Dietitians and Sports Nutritionists Need to Know. Dietetics Today, JulAug (2026). pp. 1-5.
DOI/ISBN/ISSN	n/a
Journal/Publisher	Dietetics Today Publisher: British Dietetics Association
Rights/Publisher Set Statement	Attributed to Dietetics Today and the British Dietetic Association Uploaded as per permissions provided in email from Editor on 28/09/26
License	n/a
Link	https://www.bda.uk.com/membership/publications/dietetics-today.html

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"Blackcurrants grown in New Zealand have a higher concentration of anthocyanins in comparison with those grown elsewhere"



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Evidence of the effects on performance, recovery and health of blackcurrant supplementation in sport

Dr Matthew Cook PhD

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Key points

- 1** Changes in exercise performance are small, variable and context dependent. Application for intermittent, high-intensity, repetitive exercise seems to be most commonly ergogenic. Exercise recovery is also positively affected.
- 2** The effects from blackcurrant result from its anthocyanin content, with effects upon vascular resistance and blood flow, exercising substrate utilisation and redox and inflammation.
- 3** Most studies have used standardised blackcurrant extracts, with short loading phases of seven days and a daily anthocyanin dose of ~210mg per day, with the final dose given two hours before the exercise demands.

New Zealand blackcurrant anthocyanins for performance, recovery and health: what dietitians and sports nutritionists need to know

Dr Matthew Cook looks at blackcurrant supplementation in sport, summarising the evidence for effects on performance, recovery and health

Dietary supplements are now a routine feature of the sports nutrition landscape, used to support energy availability, training adaptation, recovery and general health. As the supplement market has expanded, so too has the range of products offering increasingly concentrated doses of specific compounds.

Over the last decade, this has fuelled a noticeable rise in interest in polyphenols and food-derived bioactives as potential tools for athletes. Among these, anthocyanin-rich blackcurrant has emerged as a prominent example of how plant phytochemicals may influence physiological responses to exercise.

This article offers an overview of blackcurrant supplementation, summarising the evidence for effects on performance, recovery and health. The aim is to help dietitians and sports nutrition practitioners interpret a growing evidence base and to provide practical considerations for those exploring blackcurrant as part of a nutrition strategy.

Why New Zealand blackcurrant should be on the sports nutrition radar

Blackcurrant (*Ribes nigrum*) is rich in the flavonoid anthocyanins, the polyphenolic compounds responsible for their dark colour. Anthocyanins confer health benefits from antioxidant, anti-inflammatory and immunomodulatory effects.

The literature available has provided positive observations from supplementation of anthocyanin-rich New Zealand-grown blackcurrant (NZBC) for performance, recovery and health-related outcomes. The blackcurrants grown in New Zealand have a higher concentration of anthocyanins in comparison with those grown elsewhere,¹ primarily a result of growing conditions and high ultraviolet light exposure.

Exercise exposes athletes to oxidative damage and muscle damage. The antioxidant and anti-inflammatory responses from anthocyanins are therefore of interest to ameliorate these and bring about positive responses that support performance, recovery and health in athletes.

For those practising sports nutrition and supporting athletes, it is commonplace to see claims from new ergogenic aids. However, being research-informed is a cornerstone of delivery and it is worth recognising the evidence base now available for studies using NZBC in sports nutrition. For example, over the last 12 years, the interest in blackcurrant applications for sports nutrition has increased. A PubMed literature search ("blackcurrant" AND "exercise"), filtered for prior to 2014, shows there are only 21 studies available, but since this point there are >105 studies.

How to supplement and dose with NZ blackcurrants

Most sport and exercise studies have used standardised, capsulated extracts made from New Zealand-grown blackcurrant. The most commonly applied and evidence-supported protocol is a seven-day loading phase, providing around 210mg of anthocyanins per day, delivered as two 300mg extract capsules spread morning and evening. In many trials, the final dose is taken approximately two hours before the exercise or testing session.

While whole blackcurrants contribute anthocyanins in the diet, relying on food alone raises practical challenges of seasonal availability, variability in anthocyanin content and the feasibility of consuming enough berries to reliably match the doses used in research. In applied sporting settings, standardised extracts can therefore be advantageous because extracts allow accurate dosing and consistent anthocyanin delivery, aligning more closely with the controlled conditions under which performance and recovery outcomes have been evaluated.

It is important to consider the dosing used within these studies against the typical daily intake of flavonoids/anthocyanins within the diet. Even in the most health-conscious high consumers, intake is ~130mg/day of flavonoids.² This underscores that supplementation in these studies is then above what would be expected to be consumed in a diet high in fruits and vegetables. It is also worth noting that anthocyanins appear to have low bioavailability; while there is some evidence they may accumulate in certain tissues, it is likely that anthocyanin-derived metabolites, rather than the parent anthocyanins themselves, account for many of the observed effects.

Underpinning mechanisms

As with many dietary supplements, there seem to be multiple mechanisms for action, and these should be considered when seeking the desired outcome from supplementation, for example, supporting recovery during congested training or competition schedules, metabolic responses in endurance competitions or vascular benefits that support performance or health.

Vascular function and blood flow

Frequently discussed are the effects of anthocyanins as vasoactive compounds, influencing endothelial function and blood flow. The practical implications are that if a dietary supplement can improve blood flow, it should improve performance where oxygen delivery and metabolite clearance are limiting factors.

For example, in a study using healthy males,



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participants completed 120 minutes of prolonged sitting, followed by intermittent hand-grip exercise to volitional fatigue. After a single dose of New Zealand blackcurrant extract (~170mg anthocyanins), vascular resistance decreased and blood flow within the forearm was maintained, although there were no observed effects upon the number of repetitions completed (blackcurrant 74 ± 29 vs placebo 77 ± 45 repetitions).³ Blood flow during muscular contraction

has also been explored. In one study, participants performed a 120-second isometric quadriceps contraction at 30% of maximal isometric voluntary contraction. After seven days of NZBC extract supplementation (210mg anthocyanins/day), femoral artery diameter was around 8% larger. These vascular changes coincided with reduced vastus medialis activation measured by electromyography, alongside lower total peripheral resistance and higher cardiac output, assessed non-invasively via finger photoplethysmography during the sustained contraction.⁴

Substrate utilisation

The first observation for an alteration in fat and carbohydrate utilisation during exercise from NZBC supplementation was from Cook et al.⁵ observing a 27% increase in fat utilisation (blackcurrant: 0.44 ± 0.12 vs placebo: 0.37 ± 0.15 g/min, $P < 0.05$) during cycling at 65% $\dot{V}O_2$ max in trained cyclists following seven days intake of 105mg/day anthocyanins. Since this time, there have been 15 more studies using the same NZBC extract product and a recent meta-analysis reported that blackcurrant increased fat utilisation by 0.042g/min and decreased carbohydrate utilisation by 0.099g/min during exercise.⁶ If scaled across two hours of moderate-intensity exercise, this would then equate to 5g of extra fat metabolised. Lastly, the review found that this finding has not been consistent with responses varying by training status, sex, dosage and exercise modality.⁶ This will be of interest within endurance contexts where sparing carbohydrate stores might support performance and decisions of additional supplementation. Further recent mechanistic work demonstrated greater utilisation of intramuscular triglycerides within type I muscle fibres during moderate-intensity cycling for one hour following blackcurrant anthocyanin supplementation.⁷

Studies exploring responder and non-responder characteristics are emerging and are important to determine how best to apply NZBC supplementation. A secondary analysis of seven cohort and three case studies (46 females; 71 males) demonstrated that those who have higher carbohydrate oxidation while on placebo or control (i.e. without blackcurrant)

respond more to blackcurrant and have a greater fat oxidation response.⁸ Sex-specific work has also begun to clarify whether males and females respond differently. In a comparison of 22 participants (11 males; 11 females), following 60 minutes of treadmill exercise at 50% $\dot{V}O_2$ max after seven days of NZBC (210mg/day anthocyanins), there was no clear difference in the magnitude of the fat oxidation response between sexes. However, when individual variability was examined, the change in fat oxidation correlated with body fat percentage in females only ($r = 0.691$, $P = 0.019$), suggesting that body composition in females may help predict who is most likely to benefit.⁹

Investigations have also been completed with other anthocyanin-rich foods/berries (i.e. cherry, blueberry, blackberry). However, the evidence base is generally smaller and outcomes less consistent, potentially reflecting differences in anthocyanin profile, dose and study design, and in turn warrants future investigation.

Redox and inflammation – modulation, not elimination

Exercise triggers oxidative and inflammatory signalling that is essential for training adaptation. The aim in sports nutrition is therefore not to 'block' these responses but to avoid excessive or prolonged perturbations that may delay recovery and compromise subsequent performance.

Anthocyanins may help regulate redox-inflammatory balance through several complementary pathways, including upregulation of cAMP–PKA–CREB signalling to support glutathione synthesis,¹⁰ increased expression of endogenous antioxidant enzymes such as superoxide dismutase and catalase¹¹ and downregulation of pro-inflammatory signalling via NF- κ B.¹² In applied sport, Kaçar et al.¹³ reported that elite male taekwondo athletes undertaking repeated high-intensity training alongside seven days of New Zealand blackcurrant extract (600mg/day; 210 mg/day anthocyanins) exhibited lower oxidative stress (ROS and protein carbonyls) and lower inflammatory cytokines (TNF- β , IL-6) than when compared with a placebo. Furthermore, Hurst et al.¹⁴ observed higher plasma antioxidant capacity immediately pre-exercise following ingestion of 3.2mg/kg body mass blackcurrant anthocyanins one hour before exercise. Taken together, these findings support the possibility that NZBC may prime antioxidant and inflammatory responses, enhancing resilience to the oxidative-inflammatory challenge of exercise, rather than simply suppressing signalling outright.

Exercise performance outcomes

Studies examining performance from NZBC consumption have shown positive effects for continuous and intermittent exercise performance. However, as is common in sports nutrition research, these findings have not always been consistent. A 2020 systematic review and meta-analysis focusing on performance following NZBC supplementation concluded that supplementation produced a small improvement in performance (standard mean percent effect 0.45%, $P = 0.01$) and suggested an effective anthocyanin dose range around 105–210 mg prior

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to exercise.¹⁵ The first observations of performance benefits from NZBC demonstrated that seven days' supplementation of 105mg/day NZBC anthocyanins in trained cyclists increased laboratory exercise performance in a 16.1km cycling time-trial by 2.4% (blackcurrant: 1678±108, placebo: 1722±131s).⁵ However, this was not repeated by Montanari et al.¹⁶ following a higher dose of intake (210mg/day), again performing a 16.1km laboratory cycling time-trial. For a recent review on the ergogenic performance effects of blackcurrant, readers are directed to Willems et al.¹⁷

Effects upon intermittent exercise performance have also been examined and present a useful application to team sports where they are characterised by reported high-intensity and maximal-intensity bouts, and it can be argued that the exercise-induced oxidative stress and inflammation during repeated exercise is higher than during continuous exercise. Perkins et al.¹⁸ undertook the first investigation on repeated incremental high-intensity treadmill running, following seven days' intake of NZBC extract (105mg/day anthocyanins), with participants able to complete more running bouts following blackcurrant versus a placebo (blackcurrant: 35±6, placebo: 32±4 bouts, $P=0.02$). Using the same intermittent high-intensity treadmill running protocol, (6×19s high-intensity running; 80% $\dot{V}O_2$ max, +5% per stage, interspersed with 15s active recovery at 50% $\dot{V}O_2$ max and 60s passive recovery between stages, followed by +2.5% $\dot{V}O_2$ max increments until exhaustion), Perkins et al.¹⁹ had participants complete the protocol four times, twice on placebo and twice following NZBC supplementation (210mg/day), each taken for seven days. The study observed that NZBC extract increased total running distance by ~8% on average (328 metres further) but, critically, only about half were consistent 'responders' across repeated trials beyond a smallest worthwhile change threshold.¹⁹ Sports nutritionists should welcome these types of study designs, as it can be argued that for confidence in a supplement working, it needs to work as intended every time.

The available evidence suggests inconsistent findings for effects upon endurance performance-enhancing effects from NZBC, with the current evidence indicating that high-intensity repeated efforts seem to show the most consistent effects. Lastly, it is worth noting that fruit-derived polyphenols are now recognised by the Australian Sports Commission, with emerging potential as a performance-enhancing nutritional aid.²⁰

Exercise recovery outcomes

Recovery from exercise-induced muscle damage and associated soreness, dysfunction, oxidative stress and inflammation may take days to weeks, depending on the exercise demands. The occurrence of these effects is dependent on the intensity, duration and whether the exercise was unaccustomed. Athletes undertake training to bring about adaptation, in which oxidative stress and inflammation contribute to the process.

A double-blind, randomised, parallel-group trial in non-resistance-trained men and women found that NZBC extract (300mg/day; 105mg/day anthocyanin) supported recovery following an exercise protocol

designed to induce muscle damage. Participants completed repeated maximal concentric and eccentric actions of the biceps brachii on an isokinetic dynamometer. Across the subsequent 96 hours, creatine kinase remained elevated in the placebo condition, whereas values were lower with blackcurrant (blackcurrant: 635±921 U/L vs placebo: 4021±4319 U/L). This was paired with less soreness experienced with the blackcurrant during the first 48 hours after the exercise. Those who consumed blackcurrant also experienced a faster recovery of muscle function (maximal isometric torque), with force returning to the baseline by 96 hours.²¹

When might New Zealand blackcurrant be most useful?

Combining our understanding of the effects from New Zealand blackcurrant, the application of findings from the literature offers support towards several contexts where anthocyanin supplementation from blackcurrant may be useful.

- 1 Congested schedules: situations where there is limited time for recovery and quick turnaround is essential (tournaments, back-to-back matches and heavy travel)
- 2 Unaccustomed training loads: return from injury, pre-season, introduction of eccentric or plyometric work or new technical demands such as contact, which recovery from is essential
- 3 High-intensity intermittent sports: repeated bouts which amplify muscle damage, inflammatory stress and fatigue where recovery between performances is essential
- 4 Endurance blocks: situations where a shift to higher fat utilisation could be useful

Conclusions

The research work over the last 10 years on New Zealand blackcurrant anthocyanins for sports nutrition has provided a good evidence base for what practitioners can expect and how to use the supplement.

The message for practitioners is that performance benefits tend to be small, variable and context dependent, with the most consistent applied findings appearing in intermittent, high-intensity, repetitive exercise, while short-duration continuous 'best effort' tests show mixed outcomes.

For dosing, most studies have used standardised extracts with a short loading period (commonly ~seven days) and daily anthocyanin doses around ~210mg, often timing the final dose ~2 hours before key exercise.

Mechanistically, NZBC appears capable of influencing physiology through multiple pathways that are relevant to both sport and health, including vascular resistance and blood flow, alterations in exercising substrate utilisation and modulation of oxidative stress and inflammatory responses. Importantly, the recovery evidence supports a 'modulation, not elimination', and this aligns with the important consideration of supporting readiness without undermining training adaptation. It is likely that it will work well during congested schedules, unaccustomed loading or periods where recovery is a limiting factor.

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