



Staying Physically Fit and Mobile with Help from New Zealand Blackcurrants

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New Zealand scientists are discovering natural compounds from berryfruit may help with keeping us fit and mobile.

We all know exercising is good for our health and fitness but for most of us it's difficult to maintain. Furthermore more people are becoming aware that intense training can have some drawbacks, including lowering the body's immune defences and increasing risk of muscle damage. Highly trained sports people have suspected this for many years and have been searching for answers.

While there is a lot of hype out there, imagine if there truly was a food that could help us gain the most from our exercise regime, prevent some of these issues and help keep us fit, mobile and healthy. Scientists at the New Zealand Institute for Plant & Food Research Ltd (Plant & Food Research) believe they may have some foods to help.

Unique New Zealand blackcurrants

New Zealand blackcurrant is one of the fruits that has shown promise. Blackcurrants arrived in New Zealand with European settlers in the 1800's and New Zealand now grows the world's 4th largest crop volume. It has long been accepted that fruit, vegetables and grains are good for us but it is only more recently that scientists have begun investigating plant bioactive compounds and the mechanisms by which they keep us healthy. Berries such as blackcurrants, blueberries and cranberries are known for their free radical and oxidative stress fighting antioxidant qualities, containing valuable bioactive compounds such as anthocyanins, polyphenolics, flavonoids or phytonutrients as they are sometimes described. New Zealand blackcurrants are in particular characterised by a high density of anthocyanins and as a consequence they have a deep colour and have additional advantages in terms of sensory characteristics and sweetness.

Enhancing exercise benefits

A lot of research has been carried out over many years to find a food nutrient which can provide an elixir for assisting exercise. Vitamins, fish oils, anti-inflammatory drugs and complex vitamin-mineral supplements have all been researched, but found not to fully support exercise benefits. In fact, research suggests some of the stresses exercise imparts on the body are part of the ensuing health benefits and hence taking some nutrients, e.g. vitamins, at high doses may actually undo some of the beneficial effects of the workout.

In contrast, some fruit and vegetable extracts and foods rich in polyphenols and flavonoids are now being recommended for their ability to decrease oxidative stress and modulate exercise-induced inflammation and assist immunity. Data suggests that New Zealand blackcurrants might contain the 'just-right' balance of the important compounds.

Studies in Japan where scientists evaluated the ability of New Zealand-grown blackcurrants to reduce inflammation in muscle groups related to sustained computer use and keyboard typing were first to highlight the positive link between blackcurrants and exercise. The Japanese research flagged the potential of blackcurrants to reduce lactic acid build-up in muscles [1]. Scientists at Plant & Food Research have conducted a number of human intervention studies. In findings published in 2009 [2] a commercial blackcurrant powder extract was fed to a group of healthy everyday people who exercised regularly. Biochemical indicators to assess the effect of taking blackcurrant before exercise were measured. As a moderate exercise for that study, a 30-minute row at a given intensity was selected. Subjects were given a total of four capsules that contained the blackcurrant extract, approximately equivalent to 48 grams of fruit. Each individual consumed a total of 240 mg of anthocyanins, and a sugar placebo acted as a control.

Measures of biomarkers for control of exercise-induced oxidative stress and muscle damage were made as well as the ability to modulate the immune function. Figure 1 shows a key piece of data - when subjects exercised and ingested a sugar placebo there was a temporary exercise-induced oxidative stress as measured by a 1.4-fold rise in plasma protein carbonyl levels (as a biomarker of oxidative stress) at 0.5 hours. Consuming the blackcurrant fruit extract prevented the increase of exercise-induced oxidative stress as indicated by a reduced plasma protein carbonyl level compared to the placebo.

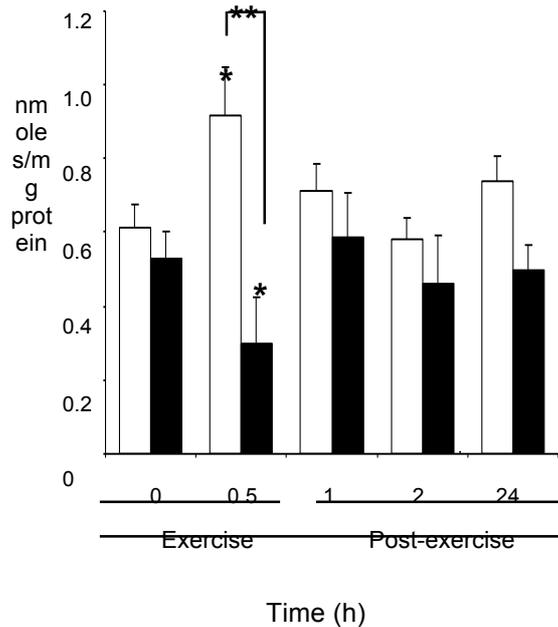


Figure 1. Protein carbonyls, a biochemical marker of exercise-induced oxidative stress, was reduced in samples of plasma from subjects receiving the blackcurrant fruit extract. Healthy untrained subjects were given a placebo (white bars) or a New Zealand blackcurrant extract (black bars) prior to and immediately after a 30-min row (80% VO_2 max). Blood samples were taken and protein carbonyl levels measured. * Represents statistical significance ($P < 0.05$) between preexercise and postexercise time points for both placebo and blackcurrant extract groups. ** Represents statistical significance ($P < 0.05$) between placebo and blackcurrant extract groups. Reproduced from Lyall, K.A. et al., (2009) [2].

These biochemical findings lead to the conclusion that blackcurrant anthocyanins likely acted as effective antioxidants against the oxidative stress induced by the 30-minute row (Figure 1). Furthermore in other exercise studies the blackcurrant extract prevented muscle damage as shown by reducing the release of the muscle molecule myoglobin into plasma after exercise (Figure 2). The effect of the blackcurrant extract on the functionality of the immune system before and after exercise has also been examined at Plant & Food Research. Using blood plasma from subjects on immune cells in the laboratory it was demonstrated that the blackcurrant extract modulated pro-inflammatory events resulting in an enhanced exercise-induced acute inflammatory response. These findings suggest an enhancement in immunity which may aid in repair of damaged tissue.

Very recent research from scientists in the UK have supported and extended these earlier findings. They examined the effect of New Zealand blackcurrant extracts on high-intensity intermittent running, post-running lactate responses (lactate being a metabolite that has a role in exercise fatigue) and cardiovascular function [3, 4]. They concluded that New Zealand blackcurrant may enhance performance and assist lactate removal in recovery from sports characterised by high-intensity intermittent exercise as greater distances were covered with repeated sprints.

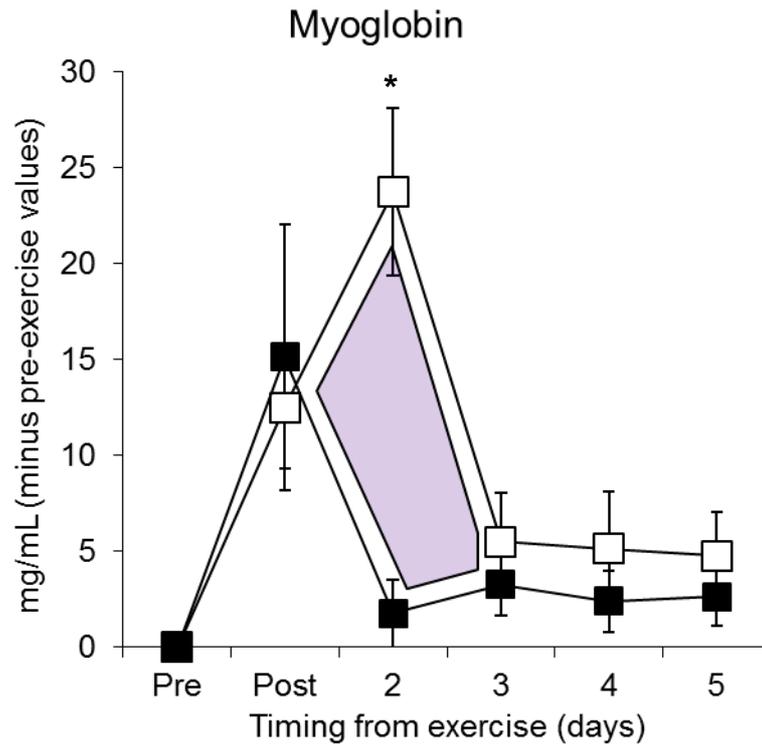


Figure 2. Consumption of blackcurrant modulates a plasma biomarker of muscle damage. Subjects underwent repetitive eccentric quadriceps contractions designed to cause muscle damage after the ingestion of either a placebo (open squares) or a New Zealand blackcurrant extract (solid squares, total 240 mg anthocyanins). The degree of muscle damage was assessed by measuring plasma myoglobin levels. * Represents statistical significance ($P < 0.05$) between treatments at the specified time post eccentric exercise. Figure based on data reported in Hurst, S.M. & Hurst, R.D. (2013) [5].

These results overall show that those who took the New Zealand blackcurrants in these studies exhibited indications of improved performance. Blackcurrant mediated a reduction in markers for oxidative stress linked to muscle damage and inflammation, assisted the clearance of the fatigue marker lactate, as well as increased cellular activity linked to immune responsiveness. These cell and tissue processes induced by blackcurrant maybe important initial responses that must occur to enable follow-on repair mechanisms to kick in. They may also be a prelude to the adaptive mechanism that enhances the human body's immune system so we are better prepared for any future similar events. It looks like natural compounds in blackcurrant improve the benefits gained from moderate exercise by complementing the body's natural way of coping, adapting and repairing itself following moderate exercise.

Of course, the research is preliminary and there is still a great deal to discover about the compounds in blackcurrants and the mechanisms offering these and other health benefits. The potential is there however. Through this and further research the knowledge gained can be used by the New Zealand food industry to both validate health claims and develop new functional foods and beverages that consumers can benefit from to enhance and complement our body's natural activity to maintain our physical fitness and overall health.

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[2] Lyall, K.A., Hurst, S.M., Cooney, J., Jensen, D., Lo, K., Hurst, R.D., & Stevenson, L.M. (2009) Short-term blackcurrant extract consumption modulates exercise-induced oxidative stress and lipopolysaccharide-stimulated inflammatory responses. *Am. J. Physiol. Regul. Integr. Comp. Physiol.* 297(1):R70-81.

[3] Perkins, I.C, Vine, S.A., Blacker, S.D., & Willems, M.E. (2015) New Zealand blackcurrant extract improves high-intensity intermittent running. *Int. J. Sport Nutr. Exerc. Metab.* Mar 26. [Epub ahead of print].

[4] Willems, M.E., Myers, S.D., Gault, M.L., & Cook, M.D. (2015) Beneficial Physiological Effects With Blackcurrant Intake in Endurance Athletes. *Int. J. Sport Nutr. Exerc. Metab.* Mar 26. [Epub ahead of print].

[5] Hurst, S.M. & Hurst, R.D. (2013). Anthocyanins, Innate immunity and exercise. Fruits and vegetables as functional foods for exercise and inflammation. In 'Anthocyanins in health and disease'. Eds, Taylor C. Wallace. CRC Press.



Biographical note: Prof Roger Hurst of Plant & Food Research leads a Food & Wellness Group that investigates the role of plant compounds in inflammation and immunity - physical fitness, mental performance and airway, skin inflammation.