

PERFORMANCE NUTRITION

DECIPHERING THE LATEST SCIENTIFIC RESEARCH TO HELP YOU GET THE MOST FROM YOUR TRAINING, DIET AND SUPPLEMENTATION

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DIETARY NITRATE—IMPROVES MUSCLE EFFICIENCY WITHOUT ANY LOSS OF FORCE

The performance benefits of nitrates in a diet are becoming increasingly recognised. The intake of nitrates has been shown to lower the energy cost of exercise but one lab-based study found that consuming nitrates could actually lead to a decline in the contractile ability of skeletal muscle. Professor Andy Jones and colleagues at the University of Exeter are leading research in this field. Their latest study, published in the *European Journal of Physiology*, sought to establish the effects of nitrate-rich beetroot juice on how much muscle force a group of volunteers could produce. Importantly, they found no association between nitrate intake and reduced force generation, and once more they found its intake lowered the energy cost of exercise. These findings further endorse the ergogenic potential of this naturally occurring dietary compound.

MAIN FINDINGS

- Measured muscle force outputs were similar after the intake of nitrate-rich beetroot or nitrate-depleted beetroot.
- Average energy cost of exercise was reduced with the intake of nitrate-rich beetroot.
- Energy cost of exercise, specifically at the end of each bout, was found to be significantly lower after the intake

of nitrate-rich beetroot in comparison to nitrate-depleted beetroot, but only when the data was adjusted per unit force output.

SIGNIFICANT METHODOLOGY

Eight volunteers took part in this placebo-controlled trial, each receiving 0.5 litres per day of nitrate-rich or nitrate-depleted beetroot juice for 15 days. Volunteers completed an exercise protocol consisting of 50 isometric maximum voluntary contractions at two and a half hours, five days and 15 days into each supplementation period. Force output and energy cost of exercise were calculated from each of the training sessions.

TAKE-HOME MESSAGE

A high intake of nitrates in the diet does not appear to reduce muscle

contractile ability. However, it does lower the oxygen cost and energy expenditure of exercise and, therefore, has major performance benefits for athletes. These performance benefits are thought to be due to an increase in nitrites in the blood stream. When nitrate-containing foods are ingested, nitrate is broken down by bacteria present in the saliva, and then enters the circulation. This pathway is blocked in the absence of these salivary bacteria, and consequently performers may wish to refrain from using high-strength antibacterial mouthwashes.

Although beetroot juice is usually chosen for scientific studies, other foods naturally rich in nitrates, which might be better suited to your palate, are readily available. Various vegetables are high in nitrate, especially celery, lettuce, leek, spinach, rocket and cabbage. In order to gain a performance edge, athletes should aim to incorporate these foods into their diet. As nitrite levels peak in the blood approximately 2-3 hours after nitrate consumption, performers should aim to consume a nitrate-rich product or meal approximately two and a half hours before training or competition.

REFERENCE

■ Fulford J, Winyard PG, Vanhatalo A, Bailey SJ, Blackwell JR, Jones AM (2013) **Influence of dietary nitrate supplementation on human skeletal muscle metabolism and force production during maximum voluntary contractions.** *European Journal of Physiology*. [Epub ahead of print]



IN ORDER TO GAIN A PERFORMANCE EDGE, ATHLETES SHOULD EAT FOODS HIGH IN NITRATE SUCH AS CABBAGE.

PHOTOCREDIT

INSUFFICIENT VITAMIN D ASSOCIATED WITH INFLAMMATION AND MUSCLE WEAKNESS

A lack of exposure to sunlight, often experienced during the dark, cold winter months, can dramatically reduce vitamin D levels in the body. The consequences of this are still to be fully established but vitamin D is known to play a key part in the maintenance of human health. Besides helping the formation and repair of bones this fat-soluble vitamin appears to influence systemic inflammation, which is a major risk factor for various metabolic diseases. A recent study undertaken by a group of researchers in the USA found that signs of inflammation were significantly increased in individuals with low vitamin D status. Furthermore, they investigated the effects of low levels of vitamin D on strength and power. There was a trend in the vitamin D insufficient group for a reduction in muscle force with a decrease in vitamin D levels. What's more, there is growing support to suggest vitamin D insufficiency can impair the functioning of the skeletal

muscles, which could have major implications for everyone, especially sports people and gym users.

MAIN FINDINGS

Concentrations of pro-inflammatory cytokines (interleukin-2, interleukin-1 β , tumour necrosis factor- α , and interferon- γ) were significantly greater in people with insufficient levels of vitamin D than those with sufficient levels. Peak power outputs were linked to serum 25-hydroxyvitamin D concentrations, with lower vitamin D levels meaning reduced peak power output.

SIGNIFICANT METHODOLOGY

Twenty-eight volunteers aged 25 to 42 were grouped according to their serum 25-hydroxyvitamin D status, which is the vitamin D metabolite present in the blood. Fourteen were in the vitamin D sufficient group and had a serum 25-hydroxyvitamin D concentration greater than 32 ng/ml. The remaining 14 were vitamin D insufficient and had a serum 25-hydroxyvitamin D concentration less than or equal to 32 ng/ml.

Multiple circulatory pro-inflammatory and anti-inflammatory cytokines were subsequently measured in the blood and a series of single-leg performance tests were undertaken to assess muscle strength and power using a leg press resistance machine.

TAKE-HOME MESSAGE

This study highlights the importance of vitamin D in the body. Not only are adequate vitamin D levels vital for bone health but also to prevent elevated systemic inflammation and to support optimal muscle functioning. To avoid detrimental effects on performance, athletes must ensure they get adequate vitamin D, especially during the winter when the body's most abundant source of vitamin D—the sun—is at its least powerful. During these months, athletes should seek foods naturally rich in vitamin D, such as oily fish and eggs, and also fortified foods, such as certain breakfast cereals, and dairy products. A daily vitamin D supplement can also help. D3 is a good option. However, those taking supplements must ensure they do not exceed the recommended dose, as excessive intakes of vitamins, especially those fat-soluble in nature (vitamins A, D, E and K), can be toxic to the body. **M&F**

REFERENCE:

■ Barker T, Martins TB, Hill HR, Kjeldsberg CR, Dixon BM, Schneider ED, Henriksen VT, Weaver LK (2012) **Circulating pro-inflammatory cytokines are elevated and peak power output correlates with 25-hydroxyvitamin D in vitamin D insufficient adults.** *European Journal of Applied*

Performance Nutrition is a London-based consultancy, providing comprehensive support to elite and recreational athletes. Director James Collins is a leading sport and exercise nutritionist, who worked with Elite Sports in Great Britain in the run-up to the 2012 Olympics. He is also head nutritionist for Arsenal FC. For further information visit www.theperformancenutritionist.com

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A LACK OF EXPOSURE TO SUNLIGHT CAN DRAMATICALLY REDUCE VITAMIN D LEVELS

LEIGH SHRIMPSON