

The influence of dietary nitrate supplementation on skeletal muscle function and exercise performance



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Several recent studies indicate that supplementation of the diet with inorganic nitrate results in a significant reduction in pulmonary O₂ uptake during sub-maximal exercise, an effect that appears to be related to enhanced skeletal muscle efficiency. The physiological mechanisms responsible for this effect are not completely understood but are presumably linked to the bioconversion of ingested nitrate into nitrite and thence to nitric oxide (NO). Nitrite and/or NO may influence muscle contractile efficiency perhaps via effects on sarcoplasmic reticulum calcium handling or actin-myosin interaction and may also improve the efficiency of mitochondrial oxidative phosphorylation. A reduced O₂ cost of exercise can be observed within 3 hours of the consumption of 5-6 mmol of nitrate and this effect can be preserved for at least 15 days provided that the same 'dose' of nitrate is consumed daily. A reduced O₂ cost of exercise following nitrate supplementation has now been reported for several types of exercise including cycling, walking, running, and knee extension exercise. Dietary nitrate supplementation has been reported to extend the time-to-exhaustion during high-intensity constant-work-rate exercise by 16-25% and to enhance cycling performance over 4, 10, and 16.1 km by 1-2% in recreationally-active and moderately-trained subjects. Although nitrate appears to be a promising 'new' ergogenic aid, additional research is required to determine the scope of its effects in different populations and different types of exercise.

CURRICULUM VITAE

Andrew Jones PhD is Professor of Applied Physiology at the University of Exeter, UK, where he is presently Head of Sport and Health Sciences. Prof Jones received his B.Sc. in Sports Science (First Class, 1991) and his Ph.D. in Exercise Physiology (1994) from the University of Brighton, after which he completed a postdoctoral research fellowship at the University of California in Los Angeles. Prof Jones was appointed as Senior Lecturer at Manchester Metropolitan University (1997) and was promoted to Reader (2001) and Professor (2004) before joining the University of Exeter in 2005. Prof Jones is internationally recognized for his expertise in the following areas: 1) control of, and limitations to, skeletal muscle oxidative metabolism; 2) causes of exercise intolerance in health and disease; 3) respiratory physiology, particularly the kinetics of pulmonary gas exchange and ventilation during and following exercise; and 4) sports performance physiology, particularly in relation to endurance athletics. Recent work, in collaboration with colleagues in the University of Exeter Medical School, has focused on the role of dietary nitrate in enhancing nitric oxide production and in modulating blood pressure, blood flow, and muscle efficiency and performance. Prof Jones has authored more than 220 original research and review articles and is co-Editor of three books. He is a Fellow of the American College of Sports Medicine, the British Association of Sport and Exercise Sciences, and the European College of Sport Science. Jones is Editor-in-Chief of the European Journal of Sport Science and serves on the Editorial Board of nine other international journals in sports medicine and exercise science.

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