

OXIDATIVE STRESS: CAN WE AND SHOULD WE MEASURE IT IN PRACTICE?

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Free radicals cause exercise fatigue. Antioxidants impair exercise adaptations. Moderate levels of exercise-induced oxidative stress are good but high levels of exercise-induced oxidative stress are bad. These are some commonly held beliefs in our field. However, free radicals and antioxidants play complex roles in sports physiology and nutrition and it is challenging to make definitive claims for or against them. One key reason for our uncertainty is the difficulty in accurately measuring these factors. State-of-the-art redox assays often can't be applied to humans in a sports context and may require specialized expertise and equipment. Additionally, there is a shortage of well-designed studies aimed at establishing causality between molecular processes and the main physiological outcomes relevant to sports scientists, such as acute fatigue or chronic adaptations. Many previous studies in sports science have used non-specific antioxidant supplements like vitamin C, E, and N-acetyl-cysteine. They have also relied on non-specific oxidative stress markers (e.g., TBARS or total antioxidant capacity) or randomly selected antioxidant enzymes (e.g., SOD or catalase), without a clear connection to the study's core hypotheses. To understand the intricate relationship between redox processes and exercise responses and adaptations, we must move beyond traditional correlational studies. I will present examples from the literature to demonstrate how methodological decisions at the molecular level can significantly impact physiological results and vice versa. A major challenge in addressing mechanistic questions in this field is the lack of precise quantitative data on fundamental redox biology measures. This challenge is exemplified by the widespread use of the "oxidants/antioxidants seesaw" model to explain changes in oxidative stress levels. This model lacks universal numerical expression and a solid biological basis. I recognize that delving into the fundamental level of biological organization, where electron exchanges occur, in order to untangle the complexities of organismal research is a difficult challenge. However, I will attempt to provide a cool-headed perspective on the relevance of free radicals and antioxidants in sports science and nutrition.