

Introduction

- Several studies have explored various physiological outcomes when comparing low-load [as low as 30% one repetition maximum (1RM)] and high-load (60-90% 1RM) resistance training including metabolic responses, muscle activation, muscle protein synthesis, and neuromuscular adaptations.
- The impact of resistance exercise load on nitric oxide (NO) bioactivity remains unexplored.
- Recently, a non-invasive technology, the NNOXX One sensor (NNOXX Inc.), has been developed to measure real-time NO bioactivity derived from red blood cells. The NNOXX sensor measures NO bioactivity through its interaction with hemoglobin to form S-nitrosohemoglobin (SNO-Hb). SNO-Hb serves as an indirect assessment of NO bioactivity because its formation is directly dependent on the availability of NO.

Purpose

The purpose of this study was to compare the real-time muscle oxygenation and NO bioactivity response to a bout of high- vs. low-load resistance exercise.

Methods

Design: Randomized, crossover design

Participants: Sixteen recreationally active men (n=9; 22.9±4.2 y) and women (n=7; 21.1±1.8 y)

Resistance Exercise Protocol:

- Five sets of leg press and three sets of leg extension using either a high-load (70% 1RM) or low-load (30% 1RM).

Assessment:

- Muscle oxygenation (SmO₂) and NO bioactivity of the vastus lateralis were monitored using a non-invasive technology (NNOXX One sensor).

Main Findings

No differences in SmO₂ or NO bioactivity were found between the 30% 1RM and 70% 1RM conditions, suggesting similar physiological responses across both low- and high-load resistance exercises.



Non-invasive nitric oxide bioactivity measurement

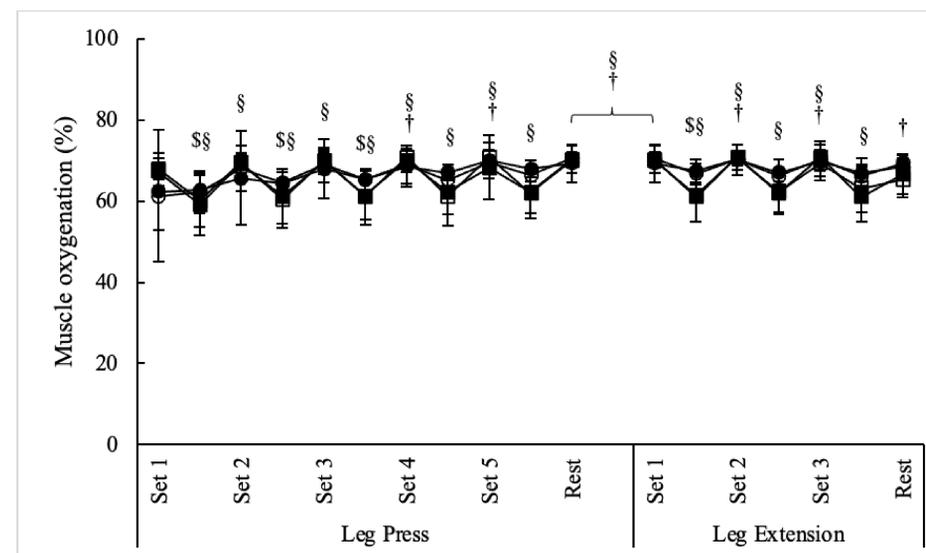
Results

More repetitions were completed across all sets at 30% 1RM compared to 70% 1RM (25.5±9.0 vs. 13.4±3.5, respectively, p<0.001). Significant (p<0.05) pre-to-post set and rest period changes were noted in SmO₂, but primarily in men. In women, SmO₂ remained unchanged across the first three sets of leg press. However, significant (p<0.05) elevations (from the onset of the first set of leg press) were noted at the start of the fourth set, as well as the beginning of each subsequent leg press and leg extension set. Only a main effect across sets (F=2.6, p<0.001, ω²=4.4%) was found where NO bioactivity was significantly (p<0.05) elevated from the start of set one of leg press at the conclusion of all sets, as well as at the start of the fifth set of leg press onward. No significant differences between relative intensity loads were seen for SmO₂ or NO bioactivity on any set when measured as raw values, percent changes and slope across sets and rest periods.

Summary and Practical Applications

These findings contribute to the growing body of literature comparing physiological responses and adaptations associated with low-load and high-load resistance exercise. While the mechanisms underlying these responses remain unclear, the study provides a foundation for future research into NO-mediated pathways and their role in muscle adaptation following resistance training.

A.



B.

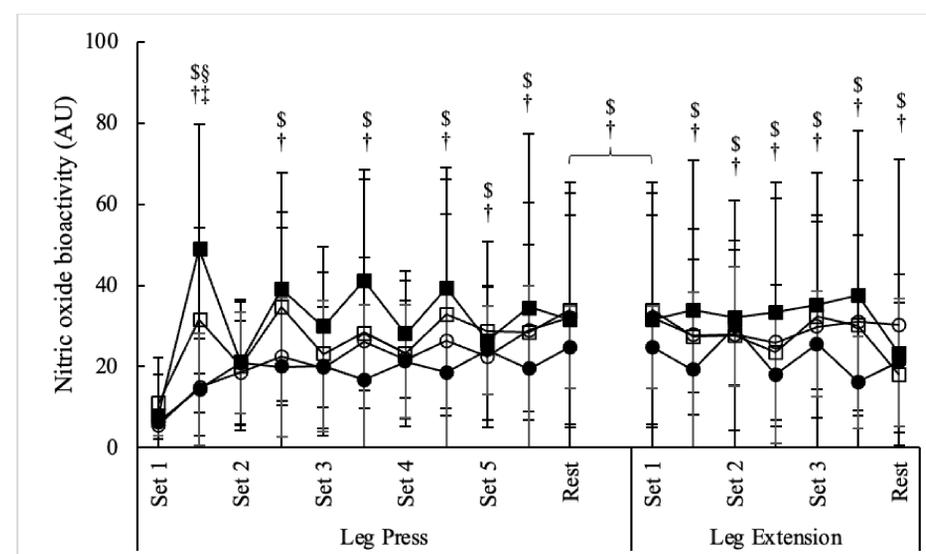


Figure 2. Sex, Set, and Time Comparisons for A) Muscle Oxygenation and B) Nitric Oxide Bioactivity across 5 Sets of Leg Press and 3 Sets of Leg Extension. Open squares = Men (30% 1RM), Open circles = Women (30% 1RM), Closed squares = Men (70% 1RM), Closed circles = Women (70% 1RM); \$ = Significantly (p < 0.05) different from the start of set 1 of leg press in men; § = Significantly (p < 0.05) different from previous time point in men; † = Significantly (p < 0.05) different from the start of set 1 of leg press in women; ‡ = Significantly (p < 0.05) different from the previous time point in women