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Muscle coactivation during fatiguing exercise performed with different resistance types

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Introduction

- Previous studies have demonstrated that exercises performed with elastic resistance requires greater muscle activation than traditional resistance types. However, there is a paucity of research into how different resistance types may alter coactivation patterns during fatiguing exercise.

Purpose

- To investigate muscle coactivation patterns during fatiguing exercise performed with elastic and constant resistance.

Methods

- **Subjects:** Eight resistance trained males (age: 26.4±4 y; body mass: 79.71±5.85 kg; height: 175.83±5.22 cm) volunteered for this study.

- **Protocol:** Subjects performed 2 maximal isometric unilateral elbow flexion repetitions at 90° of flexion for five seconds with 2 minutes rest between repetitions. Then, they performed unilateral elbow flexions to exhaustion using two types of resistance (Figure 1) in randomized order: traditional pulley machine (PM) and elastic resistance (ER). PM was performed at 30% of maximal isometric torque while the ER load was based on each subject's perception of the same intensity. A metronome was used to pace a rhythm of 2 seconds for concentric and eccentric actions. Surface electromyography of the biceps brachii (Figure 2) and the lateral head of the triceps brachii were collected. A load cell was used to record forces.

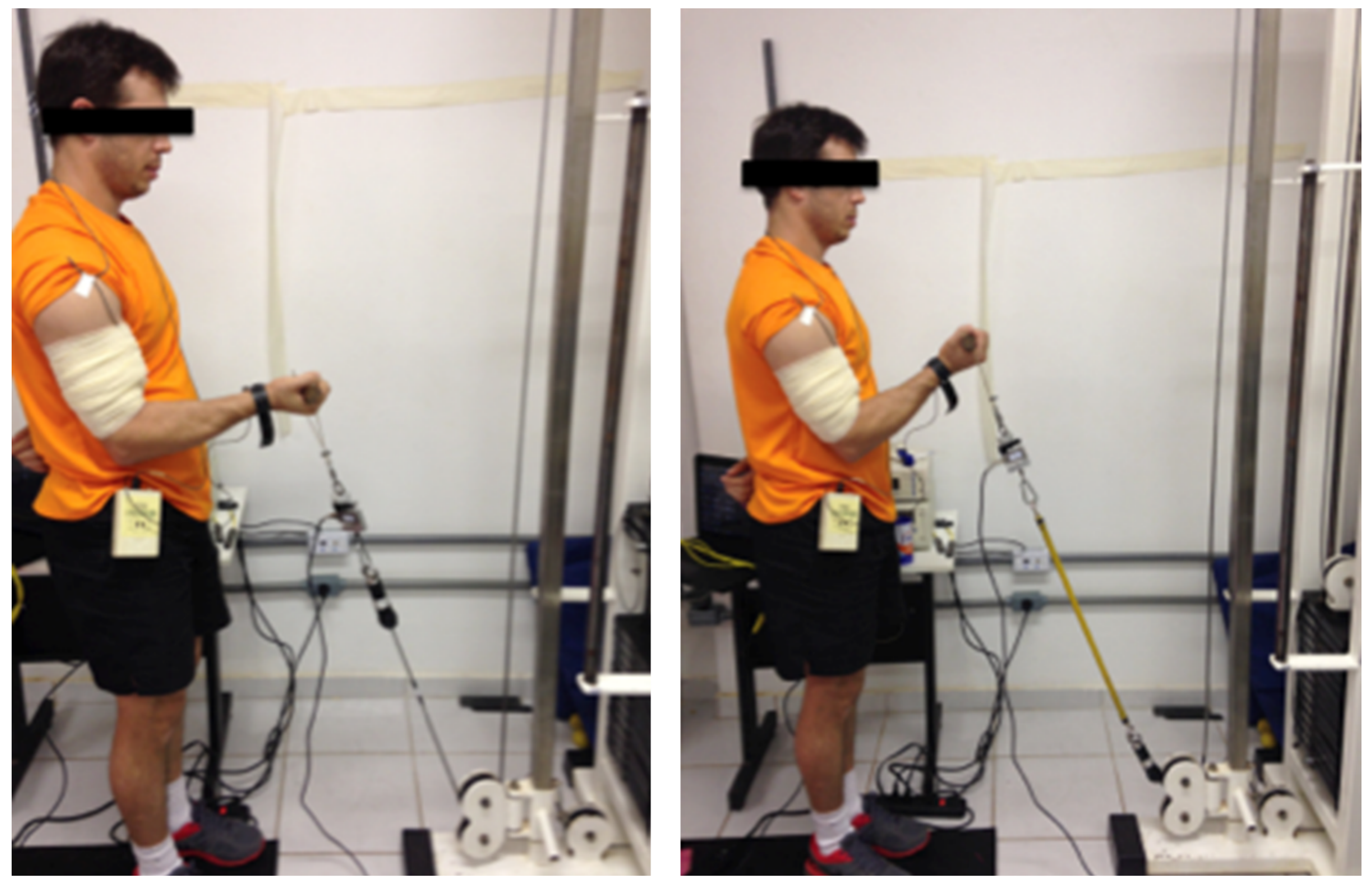

Figure 1: Elbow flexion performed with different types of resistance.

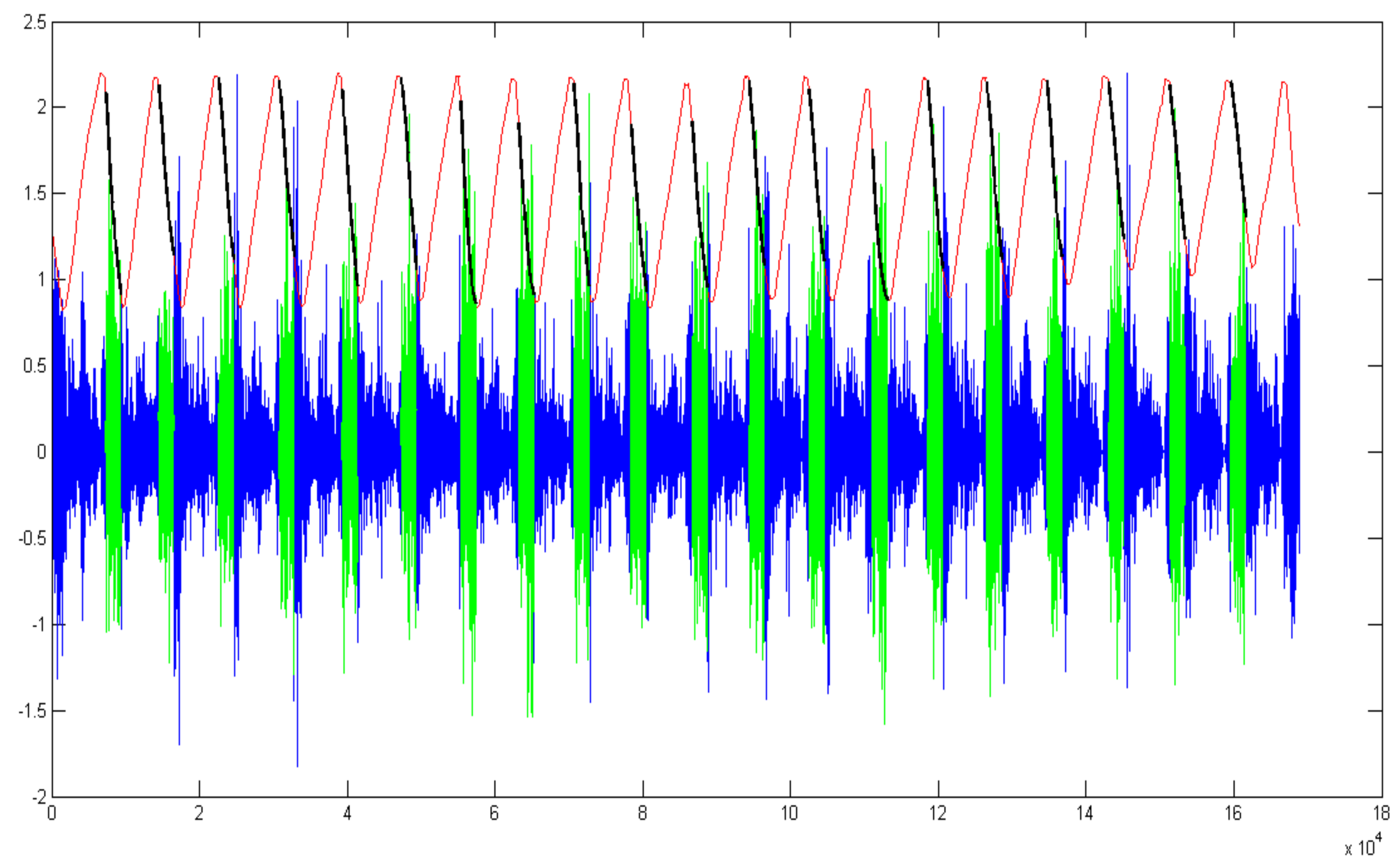

Figure 2: The EMG signal from the biceps brachii during elbow flexion at pulley machine. The green color represents the concentric action of the movement.

- **EMG Processing:** Root mean square (RMS) was calculated for each repetition to determine the coactivation index (triceps signal amplitude divided by biceps amplitude). From coactivation data, slopes of the linear regression were obtained and normalized using the linear coefficients of the regression equations (Figure 3). A specific Matlab routine was used for digital signal processing.

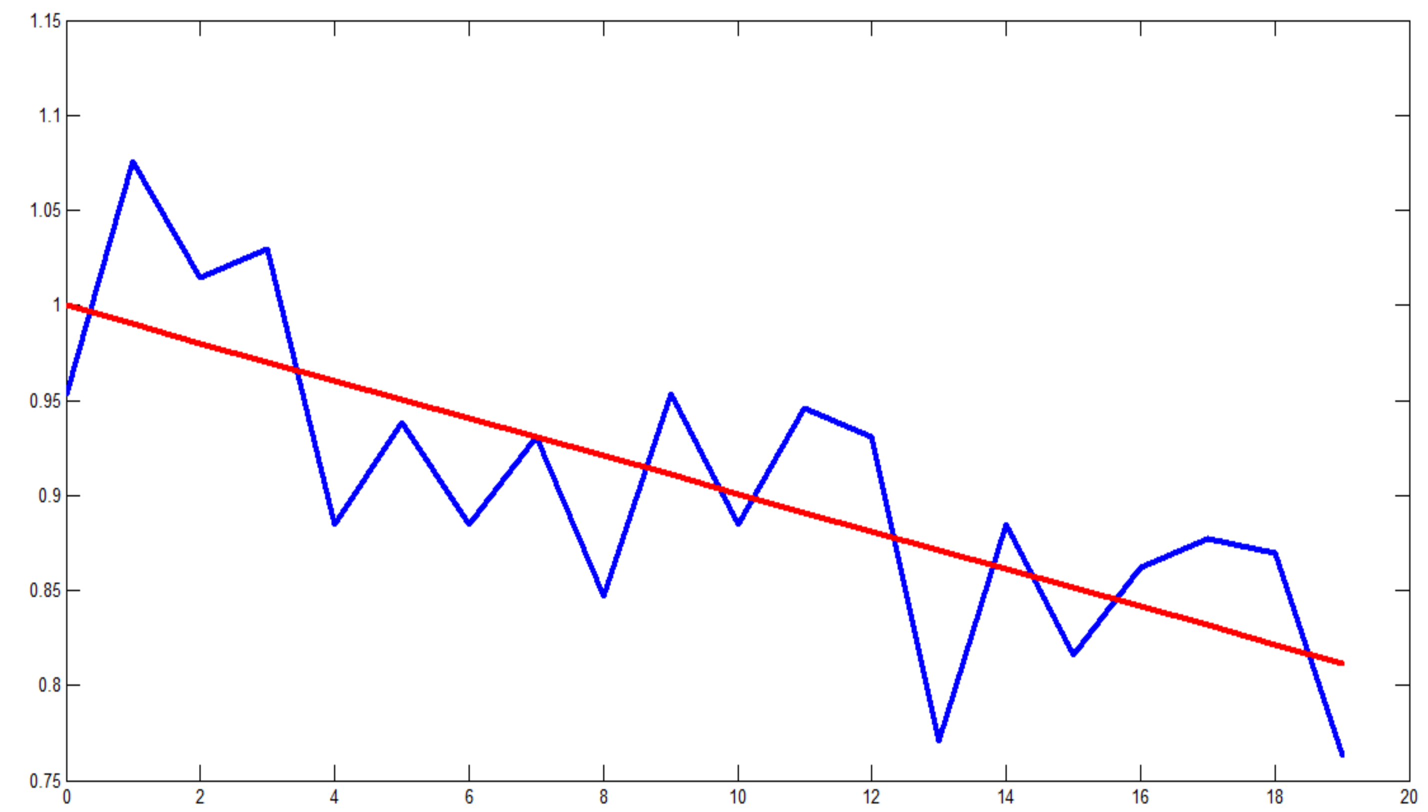

Figure 3: Normalized regression line of coactivation values.

- **Statistical Analysis:** Number of repetitions, average force produced during each exercise and coactivation slopes were compared by paired t-tests.

Results

- There were no significant differences for number of repetitions (PM : 18.67 ± 5.15; ER : 17.56 ± 5.32) or average force (PM: 11.74 ± 1.55 kgf; ER: 11.52 ± 1.14 kgf) between resistance types.

- Similarly, no significant difference was observed for coactivation slopes between conditions (PM: -0.94 ± 1.67; ER: -0.55 ± 1.85).

Conclusions

- Coactivation patterns during elbow flexion exercise performed with elastic resistance was not different from constant resistance. These results indicate that fatigue does not interfere with the agonist/antagonist relationship, regardless of the type of resistance utilized.