



Influence of Relative Load on Fatigue During One Set of Forearm Flexion Muscle Actions to Failure at Maximal Intended Velocity



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INTRODUCTION

Velocity-based training has recently gained interest as an alternative to traditional resistance training that emphasizes the relative load lifted, while performing the repetition at a slower self-selected velocity. The purpose of the present study was to examine the effects of relative load during one set of forearm flexion muscle actions to failure performed at maximal intended velocity (MIV) on performance (maximum voluntary isometric contraction (MVIC), peak force (PF), peak velocity (PV), and peak power (PP)) and neuromuscular responses.

METHODOLOGY

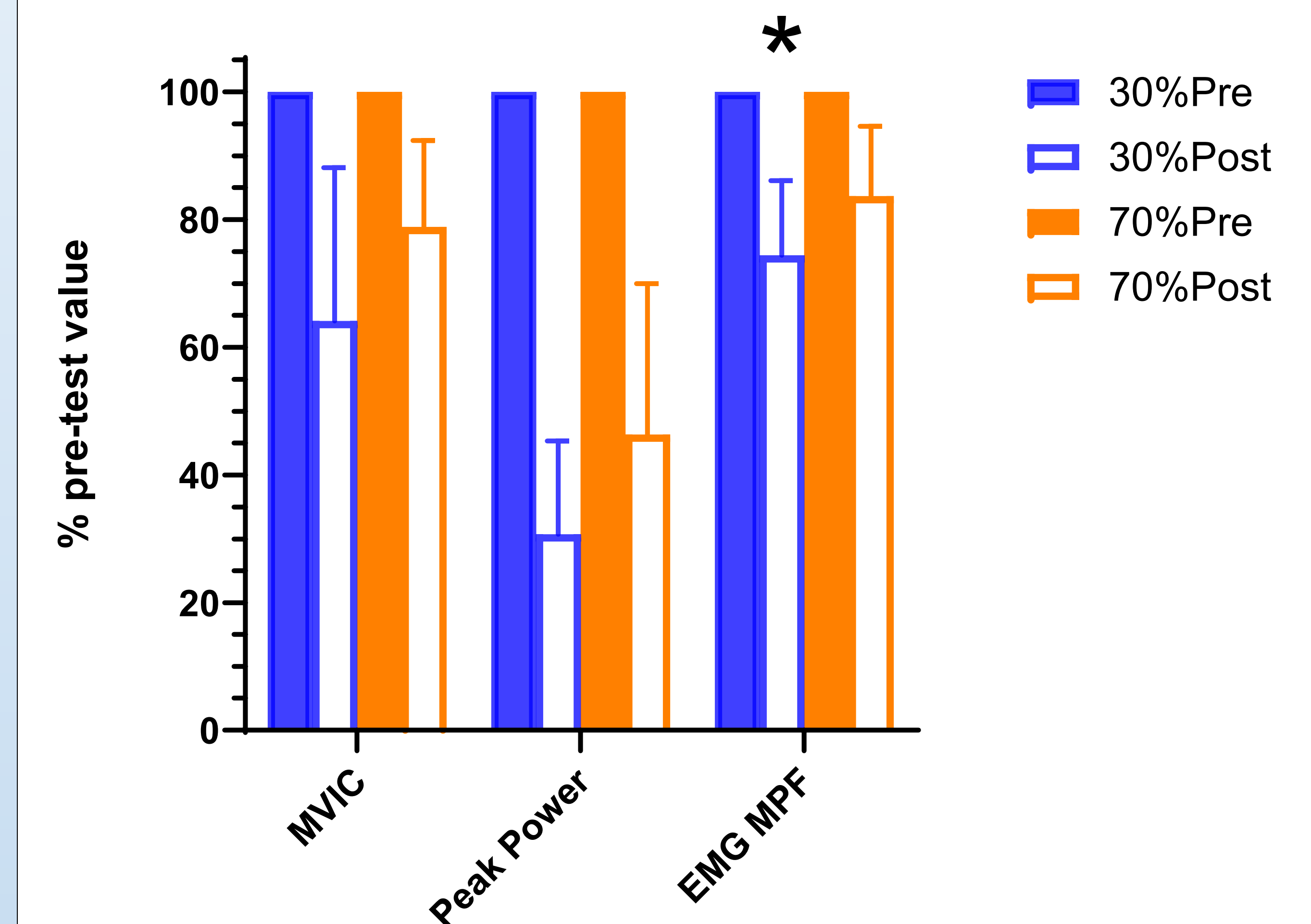
On separate days, 14 men (mean±SD: age=22.9±2.0 yrs; body mass=85.0±16.9 kg; height=178.7±5.9 cm) completed one set of forearm flexion muscle actions to failure at 30% and 70% of their one-repetition maximum (1RM), in a random order. Prior to the fatiguing task the subjects completed pre-testing which consisted of two repetitions of dynamic forearm flexion muscle actions at the load equivalent to the fatiguing task and two maximum voluntary isometric contractions, performed in a random order. Following the fatiguing task the subjects were re-tested (post-testing) in the same manner of pre-testing. All muscle actions were performed unilaterally, on a preacher curl setup with their nondominant arm. The concentric phase of each repetition was completed at MIV (as quickly as possible). Electromyographic (EMG) signals were recorded from the biceps brachii during testing, and the amplitude (AMP) and mean power frequency (MPF) values were normalized to the values from the pre-test MVIC with the highest force output. For all performance (MVIC, peak force, peak velocity, and peak power) and neuromuscular (EMG AMP and MPF) parameters, a fatigue index was calculated as the percent decline from pre-test to post-test. Paired samples t-tests were used to examine differences in the number of repetitions completed at each load, as well as in the fatigue index for all performance parameters.

Despite the low load inducing a greater magnitude of metabolic stress, the decreases in MVIC, peak velocity, and peak power were not influenced by the relative load used for the max velocity forearm flexion muscle actions.

PRACTICAL APPLICATION

The results of this study offer strength and conditioning practitioners with valuable insights into the effects of relative load during fatiguing muscle actions performed at MIV. For instance, training with lower relative loads at MIV will induce a greater metabolic stress, without negatively effecting movement velocity or PP production, compared to when training with moderate relative loads.

FIGURE 1. Fatigue responses



RESULTS

The subjects completed a significantly ($p<0.001$, $d=3.0$) greater number of repetitions to failure at 30% 1RM (64.9 ± 17.4) compared to 70% 1RM (16.7 ± 5.1). Peak force decreased more significantly ($p<0.001$, $d=1.3$) following the 30% ($32.0\pm16.8\%$) versus 70% 1RM task ($7.6\pm9.9\%$). In addition, there was a significantly ($p=0.004$, $d=0.9$) greater decrease in EMG MPF for the 30% ($25.6\pm11.7\%$) compared to the 70% 1RM task ($16.3\pm11.0\%$). There were, however, no significant ($p>0.05$) differences between the 30% and 70% tasks for the fatigue index for MVIC, PV, PP, or EMG AMP.

CONCLUSION

The results of the study indicated that, although the subjects were able to sustain repetitions to failure for longer at 30% 1RM compared to 70% 1RM, there were no load-specific effects of fatigue on decreases in MVIC, PV, or PP. In addition, there were no differences in changes in muscle excitation (EMG AMP) from pre-test to post-test. However, the 30% 1RM task induced a greater decrease in motor unit action potential conduction velocity compared to the 70% 1RM task, as evidenced by the decrease in EMG MPF.