

Establishing Equivalent Training Intensities for Isometric Bilateral-Leg and Handgrip Exercise Using the Category Ratio Scale

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Introduction

Isometric handgrip (IHG) training is commonly undertaken at an exercise intensity of 30% of a subject's maximum voluntary contraction (MVC) (McGowan et al., 2007). Matching this intensity with isometric bilateral-leg (IBL) exercise is difficult due to the different muscle mass involved. Comparative studies (Howden et al., 2002) have tended to use different exercise intensities without providing a strong rationale. Therefore, the purpose of this study was to use the Category Ratio Scale (CR-10) to establish equivalent exercise intensities for IHG and IBL, based on participant effort perception and to test the extent to which intensity can be matched, when using this method during training sessions.

Methods

A total of 26 healthy participants (male, n = 18; female, n = 8) undertook two minutes of unilateral IHG to establish the mean CR-10 values. Then, performed IBL exercise at 15, 20 and 25%MVC. The IBL intensity at which CR-10 most-closely matched the values for IHG, was identified as 20%MVC. Subsequently, an IHG and IBL training session was used, to test the extent to which the intensities were matched, according to effort perception. Ten participants (male, n = 6; female, n = 4) undertook 4 x 2 minutes unilateral IHG (30%MVC) and IBL (20%MVC) training, with 2 minutes recovery between contractions with CR-10 measured at the end of each exercise bout. A one-way independent ANOVA was used to identify the IHG and IBL intensities that were most-closely matched. To determine whether CR-10 values were significantly different during the IHG and IBL training sessions, a two-way mixed-model ANOVA was used.

Results

The intensity at which CR-10 was most-closely matched between IHG and IBL was 20%MVC. There were significant differences in the CR-10 values between IHG contractions at 30%MVC and IBL at 25%MVC and 15%MVC ($P > 0.05$) but not at 20%MVC ($P < 0.01$). Further analysis of the training data indicated that there were no significant differences in the CR-10 values between IHG (30%MVC) and IBL (20%MVC) following the first 3 bouts of exercise ($P < 0.05$). However, there was a significant increase following the final bout of exercise ($P > 0.05$).

Discussion

These results suggest when performing IBL exercise, the intensity most closely matching the IHG intensity (30%MVC) is 20%MVC. Furthermore, it can be seen from the simulated training sessions that CR-10 does not significantly differ between the two intensities until the final 2-minute bout. Therefore, it may be advantageous when undertaking one-off IBL exercise or IBL training protocols with the purpose of comparing data to that from IHG, to use 20%MVC. However, when a 4 x 2 minute training protocol is used, it may be necessary to attenuate the intensity of the 4th bout of IBL.

McGowan CL, Levy AS, McCartney N, MacDonald MJ. (2007). *Clin. Sci.* 112, 403-409.

Howden R, Lightfoot TJ, Brown SJ, Swaine IL. (2002). *Exp. Physiol.* 87, 507-515.