EFFECTS OF UNILATERAL RESISTANCE EXERCISE WITH VASCULAR OCCLUSION ON MUSCULAR FUNCTION OF TRAINED AND UNTRAINED LIMBS

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Unilateral resistance exercise is known to cause increase in muscular strength not only in trained limb, but also in contralateral untrained limb (cross education). This phenomenon is thought to be caused by neural adaptations (Hortobagyi, 2005). Several studies have shown that a low-intensity resistance exercise can cause increases in muscular size and strength when combined with vascular occlusion, partly due to enhancements of neural drive as well as endocrine response (Takarada et al. 2000). Thus we hypothesized that unilateral resistance exercise with vascular occlusion would induce strength gain in contralateral, untrained muscle, even without generation of large force.

Purpose: The purpose of this study was to see whether a low-intensity unilateral resistance exercise with vascular occlusion causes strength gain in contralateral untrained muscle.

Methods: Eighteen men performed unilateral arm exercise twice a week for 8 weeks. They were assigned into an occlusive training group (OCC, n=9) and a normal training group (NOR, n=9). Both groups performed three sets of unilateral biceps curl at 30% of one-repetition maximum (1RM). The dominant arm was trained (OCC-T, NOR-T), whereas the non-dominant arm was served as control (OCC-C, NOR-C). The subjects were instructed to perform 30 reps for 1st set, and 15 reps for both 2nd and 3rd sets with a 30-second rest interval between the sets. The OCC performed the exercise with the proximal portion of their arm compressed at 100 mmHg by an elastic belt, whereas the NOR performed the same exercise without occlusion. Cross-sectional area (CSA), maximal isometric torque, and 1RM strength of the elbow flexor muscles were measured before and after the training period. In a separate day after the 8-week training, acute changes in blood hormone concentrations after the single exercise session were also investigated.

Results: The 1RM significantly increased in a similar manner in both OCC-T and NOR-T, whereas it did not change in either OCC-C or NOR-C. The CSA and isometric torque did not increase significantly in any groups examined. In the OCC, plasma concentrations of adrenaline and noradrenaline increased significantly 15 min after the three sets of exercise. However, plasma concentration of growth hormone (GH) did not change.

Conclusion: The low-intensity unilateral arm exercise did not cause an increase in the muscular strength in contralateral, untrained muscle, irrespective of occlusion, implying that the exercise intensity is a crucial factor for the cross education effect. It should be noted, however, that the present occlusive training also failed to cause substantial strength gain and hypertrophy in the trained muscle, which may be related to negligible change in plasma GH concentration after the exercise.

References:

Keywords: Strength Training, Muscle Physiology, Neuromuscular Physiology

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