

Muscle Power and Fiber Characteristics Following 8 Weeks of Plyometric Training

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ABSTRACT

We examined changes in muscle power output and fiber characteristics following a 3 d·wk⁻¹, 8-week plyometric and aerobic exercise program. Male subjects ($n = 19$) were randomly assigned to either group 1 (plyometric training) or group 2 (plyometric training and aerobic exercise). The plyometric training consisted of vertical jumping, bounding, and depth jumping. Aerobic exercise (at 70% maximum heart rate) was performed for 20 minutes immediately following the plyometric workouts. Muscle biopsy specimens were collected from the musculus vastus lateralis before and after training. Type I and type II fibers were identified and cross-sectional areas calculated. Peak muscle power output, measured using a countermovement vertical jump, significantly increased from pretraining to posttraining for group 1 (2.8%) and group 2 (2.5%). Each group demonstrated a significant increase in fiber area from pretraining to posttraining for type I (group 1, 4.4%; group 2, 6.1%) and type II (group 1, 7.8%; group 2, 6.8%) fibers, but there were no differences between the groups. Following plyometric training, there is an increased power output that may in part be related to muscle fiber size.

Key Words: power training, fiber hypertrophy

Reference Data: Potteiger, J.A., R.H. Lockwood, M.D. Haub, B.A. Dolezal, K.S. Almuzaini, J.M. Schroeder, and C.J. Zebas. Muscle power and fiber characteristics following 8 weeks of plyometric training. *J. Strength Cond. Res.* 13(3):275-279. 1999.

Introduction

Explosive leg power is a critical component for successful performance in many athletic events. Vertical jumping ability may best exemplify this, as evidenced by the strong association between increased lower-body power and vertical jump height. An increase in lower-body strength, however, is not the only means by which to enhance vertical jump performance. Increasing the degree of coordination and skill in performing the movement and maximizing the abil-

ity to use the stretch-shortening cycle in the muscle are other integral factors in vertical jump performance (1, 6, 24).

Plyometric exercises parallel the movement patterns used by athletes in activities that involve sprinting and jumping. Lower-body plyometric exercise typically includes bounding, hopping, and various jumps with 1 or 2 legs. These exercises use the stretch-shortening cycle that occurs when a muscle undergoes a rapid eccentric elongation just before a rapid concentric contraction. The muscle is essentially stretched while active, resulting in greater force production during the subsequent concentric contraction than could be generated during a concentric contraction from a static position (18). The ability of the muscle to adapt to this stretch-shortening cycle should enable the individual to generate greater power. In fact, many studies have established the effectiveness of plyometric training for improving power output (4, 8) and vertical jump performance (1, 7, 8, 11, 13, 17, 24).

To our knowledge, no studies have addressed the influence of plyometric training on both vertical jump power production and muscle fiber characteristics. The purpose of this study was to examine the effect of plyometric training on leg muscle power output and muscle fiber size of the musculus vastus lateralis.

Methods

Nineteen physically active men (mean \pm SD; age = 21.3 ± 1.8 years, height = 185 ± 10.1 cm) voluntarily participated in the investigation. None of the subjects had participated in any structured plyometric training program, although all subjects had regularly performed resistance training and aerobic exercise for at least 3 months before beginning the study. All subjects were given a verbal explanation of the procedures involved in the study and provided written informed consent in accordance with university guidelines for human experimentation. All subjects completed a medical history questionnaire and were judged as