EFFECTS OF PLYOMETRIC, WEIGHT LIFTING, AND PLYOMETRIC PLUS WEIGHT LIFTING COMBINATION TRAINING ON JUMPING PERFORMANCE

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Introduction: Various training methods have been suggested as effective in improving vertical jumping, presumably because each method may stimulate a different component of vertical jumping performance. Enhancement of muscular strength and power, via resistance training, induces improvements in vertical jumping (Harris et al. 1999). Plyometric training, compared to other training methods, induces a greater activation of knee extensor and plantar flexor muscles; thus, the contractile machinery itself is able of producing higher mechanical outputs during drop jumping (Cavagna et al. 1981). Moreover, the movement pattern of Olympic style weight lifting is similar to vertical jumping (Garhammer 1993). Therefore, weight lifting has been proposed as an effective training method for the enhancement of vertical jumping. The purpose of this study was to compare three different training methods and their effectiveness on vertical jumping ability, as well as to explore the muscle activity alterations induced by training.

Methods: Thirty-one male students 20.4±2.6yrs (height=175.8±5.3cm, mass=71.9±3.5kg) were randomly assigned to 4 groups: Plyometric (P), Weight Lifting (WL), Plyometric plus Weight Lifting (P+WL), and Control (C) groups. The participants performed an 8-week training program (3 sessions/week, 4 sets of 5 exercises at 80-100% of 1-RM). Participants performed 3 vertical jumps: Squat Jump (SJ), Counter-Movement Jump (CMJ) and Drop Jump (DJ), from 20, 40, and 60 cm, onto a force platform (Kistler, 9281CA, 1000Hz). Electromyographic (EMG) activity of Rectus Femoris (RF), Biceps Femoris (BF), and Medial Gastrocnemius (MGAS) were recorded using an EMG interface module of the ARIEL system (sampling frequency 1000 Hz). Three-dimensional kinematic data were collected using two digital cameras (Panasonic AG188, 60 Hz). Two-way ANOVA with repeated measures was used for statistical analyses.

Results: Maximum height was improved (p<0.05) in all jumps in the WL and P+WL groups. However, in the PL group maximum height was improved only in DJs. EMG activity of RF and MGAS muscles was increased (p<0.05) during CMJ and DJ from 60 cm only in the WL group. The kinematic data analysis showed that knee and ankle angular velocities during CMJ and knee angular velocity during 60cm-DJ were increased in the PL group (p<0.05). Improvements were observed in both kinematic and kinetic parameters in the P+WL group (p<0.05).

Discussion/conclusion: Our results confirmed that olympic weight lifting exercises are associated with enhanced vertical jumping performance due mainly to kinetic and secondary to kinematic movement adaptations. Plyometric training has also produced positive effects on kinematic characteristics mainly during drop jumping, possibly due to the training specificity principle. P+WL training was associated with positive kinetic and kinematic improvements in all jumps, which suggests greater training adaptations. Our results suggest that weight lifting in combination with plyometric exercises is more effective in improving jumping performance.

References:

Keywords: Jumping, Weightlifting, Training