

# Acute Effect of Plyometric Training Combined with Whole Body Vibration on Lower Limb Power Performance

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## SUMMARY

The objective of this study was to investigate the acute effect of plyometric training combined with whole body vibration on the countermovement jump (CMJ) height and hip, knee and ankle joints moment and power. 11 male college players of Division I volleyball and basketball teams voluntarily participated in the study. The motion system and force platforms were used to collect and analyze the data. Subjects performed 3 CMJs as pre-tests with 1-min rest between trials. Then 5 training sessions, (1) whole body vibration: 30Hz/4mm/10 seconds  $\times$  3 sets with 1-min rest between sets, (2) plyometric training: 5 times of drop jump from an individualized drop height  $\times$  1 set, (3) resistance training: 5RM squats, (4) combination of resistance training and plyometric training sessions with 4-min rest between sessions and (5) combination of whole body vibration and plyometric training sessions with 4-min rest between sessions were completed on separate days. After each training session, 3 CMJs were performed in 4 minutes as post-tests. All training sessions showed statistically significant differences in the increase of CMJ height, knee maximal moment and, ankle maximal power between pre-test and post-test ( $p < .05$ ). No difference was found between sessions. These findings indicated that plyometric training, whole body vibration, resistance training, combination of resistance training and plyometric training, and combination of whole body vibration training and plyometric training provide positive acute effect in 4 minutes on CMJs and specifically contribute to knee and ankle joints.

## INTRODUCTION

According to previous report [1, 2, 3], the countermovement jump performance can be improved after the high intensity training (include whole body vibration, plyometric training, resistance training). However, the acute effect of plyometric training combined with whole body vibration on lower limb power performance, has not been examined. For this reason, this purpose of investigation was to compare the acute effect of 5 different training session (include whole body vibration, plyometric training, resistance training, plyometric training combined with whole body vibration and plyometric training combined with resistance training) on the countermovement jump height and hip, knee and ankle joints moment and power.

## METHODS

11 male college players of Division I volleyball and basketball teams voluntarily participated in the study (age,  $21.1 \pm 2.1$  years; height,  $181.8 \pm 7.2$  cm; body mass,  $77.2 \pm 13.7$  kg).

All the subjects visited the laboratory 7 times in 7 days. On first day and second day, the subject was to examine 5RM (5 repetition maximal) [5] and individual drop heights for plyometric training [4]. On the third day to seventh day, the subject was to perform 5 training sessions, (1) whole body vibration: 30Hz/4mm/10 seconds  $\times$  3 sets with 1-min rest between sets, (2) plyometric training: 5 times of drop jump

from an individualized drop height  $\times$  1 set, (3) resistance training: 5RM squats, (4) combination of resistance training and plyometric training sessions with 4-min rest between sessions and (5) combination of whole body vibration (TVR4900, Taiwan) and plyometric training sessions with 4-min rest between sessions were completed on separate days. Before the commencement of the experimental trials, a general warm-up protocol consisted of cycling on a stationary cycle (Magtonic, MAG-5100, Tonic Fitness Technology, Taiwan) at a self-selected pace for 5 minutes. Then the subject performed 3 CMJs as the baseline measurement (pretest) with a 20-second rest between jumps. After the pretest, the subjects were allowed a 1-minute static recovery and then randomly assigned to one of the 5 training session. After the training session, the subjects performed 3 CMJs (post-test) at the recovery times of 4 minutes.

All dependent variable were recorded using 11 Eagle cameras (Motion Analysis Corporation, Santa Rosa, CA, USA) at a 200-Hz sampling rate and 2 force platforms (AMTI Inc., Watertown, MA, USA) at a 2000-Hz sampling rate. The cameras were synchronized to 2 force platforms. All dependent variable were transformed and analyzed using Motion Monitor software (Innovative Sports Training, Inc., Chicago, IL, USA).

Repeated-measure 2-way (5 training session  $\times$  2 times) ANOVA was used to compare the differences between 5 training session and times (pretest and posttest) for each dependent variable from CMJ performance.

## RESULTS AND DISCUSSION

All training sessions showed statistically significant differences in the increase of CMJ height, knee maximal moment and, ankle maximal power between pre-test and post-test ( $p < .05$ ). No difference was found between sessions.

In this study, all training session statistically significant differences in the increase of CMJ height, knee maximal moment and, ankle maximal power between pre-test and post-test. We suppose that all training session can achieve the PAP effect without increasing fatigue [1, 2, 3].

## CONCLUSIONS

These findings indicated that plyometric training, whole body vibration, resistance training, combination of resistance training and plyometric training, and combination of whole body vibration training and plyometric training provide positive acute effect in 4 minutes on CMJs and specifically contribute to knee and ankle joints.

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