Portuguese Journal of Sport Sciences
11 (Suppl. 2), 2011

EXAMINATION OF ACUTE WHOLE-BODY VIBRATION ON MAXIMAL VERTICAL JUMP HEIGHT IN COLLEGIATE VOLLEYBALL ATHLETES

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The purpose of this study was to compare the acute effects on maximal countermovement vertical jump after completing three sets of 30 second body weight squats with and without whole body vibration among Division I volleyball players. Participants (n=7) underwent three days of testing: one baseline, one with WBV at 45 Hertz and one without WBV. The latter two testing days involved a warm-up with three sets of 30-second body weight squats on a vibration platform. Each participant then completed a countermovement vertical jump, measured by a Vertec, after passively resting for one minute and five minutes, respectively. Results indicated a significant difference between baseline and vibration vertical jump means (p=.039). No other significant differences were detected.

KEY WORDS: body weight squats, countermovement vertical jump, Vertec

INTRODUCTION: Volleyball is a power sport requiring quick, explosive movements. Jumping ability, particularly as a front row player, plays a key role during vertical jump movements, such as blocking or hitting. Therefore, finding ways to improve vertical jump performance before and during a match could have a greater impact on overall performance. In the last ten years, whole-body vibration (WBV) has emerged as a means for improving strength, power, and jumping performance in sports training and rehabilitation practices. When used during exercise, WBV increases muscle activation via reactive forces produced by and within the human body (Rittweger, 2010). During exercise, these reactive forces induce a cyclic transition between eccentric and concentric muscle contractions, while eliciting an excitatory neurophysiologic response of the muscle spindles (Rittweger, 2010). The interaction of this rapid stretch-shortening cycle and increased motor activation through WBV allows the muscles to contract and relax at a higher rate activating more muscle fibers as a means for enhancing athletic performance. Frequencies between 25Hz and 50Hz and bouts lasting between 30 and 60 seconds have been shown to produce the greatest improvements in strength and power performance (Paradisis & Zacharogiannis, 2007). After examining 10 sets of WBV at five different frequencies between 25 and 45 Hertz, Hazell et al. (2007) found the greatest increase in muscle activity at the 40 and 45 Hertz frequencies compared to the lower frequencies. Furthermore, Armstrong et al. (2010) examined rest periods after one minute WBV bouts at 35-50 Hertz and found improved jumping performance decreased after 5 minutes following WBV activity. However, during an acute bout of WBV appears less consistent when examining its effects on neuromuscular performance and maximal jump height (Gerodimos et al., 2010). The purpose of this study was to compare the acute effects on maximal countermovement vertical jump after completing three sets of 30 second body weight squats with and without whole-body vibration in Division I volleyball players.

METHODS: Seven Division I female volleyball players (all front row players) were involved in three days of testing with a minimum of 48 hours between each test-day. On Day 1, each participant took part in an initial testing session consisting of a dynamic warm-up followed by a maximal countermovement vertical jump test after one minute and five minutes of passive rest (standing). The CMJ was performed by bending at the knees and hips while using their arms to jump, and each participant performed three consecutive jumps to determine maximal jump height. This session provided a baseline of the participants' vertical jump height. The participants were then randomly assigned to the following two days of testing. Testing on

Days 2 and 3 were identical with the exception of the vibration. The sessions on Days 2 and 3 each lasted approximately 15 minutes and adhered to the following protocol: five minutes of dynamic warm-up, two minutes of passive rest (standing), three minutes of training either with or without WBV, one and five minutes of passive rest (standing) followed by a maximal countermovement jump test, comparable to that performed at baseline testing. Participants completing the testing with the vibration platform turned on during Day 2 completed the testing with the vibration platform turned off on Day 3. Likewise, the participants who completed the testing with the vibration platform turned off on Day 2 completed the testing with the platform turned on during Day 3 testing. Testing with the vibration platform turned on was completed with the vibration frequency set at 45 Hertz. All training on the vibration platform consisted of 3 sets of 30-second body-weight squats. The participants were verbally encouraged to perform the maximal number of repetitions that they could during each set of 30 seconds. A 30 second rest time was given between each set of body-weight squats, allowing for a 1:1 work to rest ratio.
A Two-Way Repeated Measures ANOVA was performed to determine significant differences between test types (baseline, vibration, and non-vibration) and rest duration (one minute and five minute rest periods). Tukey's pairwise comparison was performed to examine main effects within treatments.

RESULTS: Mean vertical jump heights across all three test types and rest durations are displayed in Table 1. Tests of within-subjects effects indicated a significant difference of test type (p=.034; F=4.559), but no significant differences were observed between rest duration (p=.812; F=.062) or the interaction of test type and rest duration (p=.616; F=.504).

Table 1
Two-Way ANOVA mean vertical jump height (in cm)

Rest Duration	Baseline	Vibration	No Vibration
1 minute	56.8 ± 5.8	59.3±5.2	59.1±5.4
5 minute	57.2±5.3	59.1±2	58.6±5.5

The main effects across test-types are represented in Figure 1. Tukey's pairwise comparison indicates a significant difference between baseline and vibration means (p=.039), however, no other significant differences were observed.

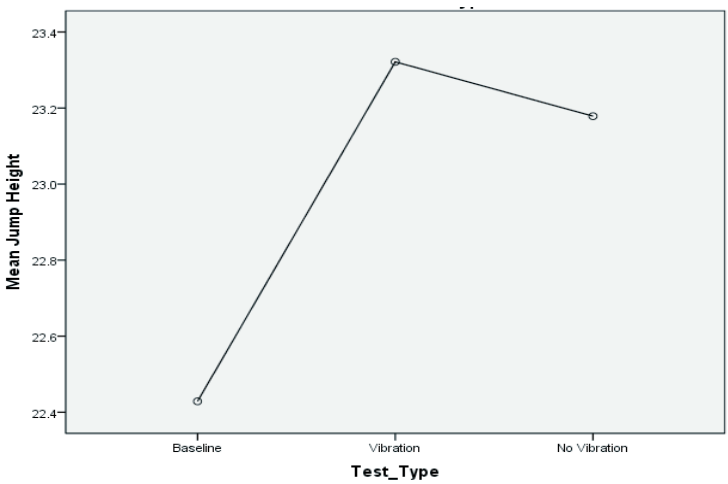

Figure 1: Main Effect Plot for Test Type.

DISCUSSION: Results of this study indicate a significantly greater increase in maximal vertical jump height with WBV compared to baseline. However, there was no significant difference in jump height when comparing the use of WBV to no WBV, which suggests performing body weight squats prior to a maximal power movement may have a greater impact on vertical jump height than WBV alone. This is consistent with previous research, which found no significant improvements in vertical jump performance after a single bout of WBV at varying frequencies (Gerodimos et al., 2010). Overall, vertical jump height improvement was slightly higher with WBV than without, which suggests WBV may play a role in improving jump height. Bedient et al. (2009) found significant improvement in vertical jump height after 30 seconds of WBV at 30 Hertz. Therefore, acute bouts of WBV at 45 Hertz may provide too much neuromuscular activation to enhance vertical jump performance compared to lower frequencies of WBV.

CONCLUSION: Vertical jump performance and power output are key components in various types of training and competition, and even the smallest improvement can have a profound effect on the overall outcome. This study suggests that body weight squats with WBV performed may provide enough muscle activation to produce an increase in maximal vertical jump height. However, lower frequencies may have a greater impact on overall jump performance than higher frequencies. Therefore, future research is needed to determine how acute WBV and related frequencies may affect maximal power and vertical jump performance.

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Acknowledgement
The researchers thank the North Dakota State University volleyball players for participating in this study and the NDSU wellness center for allowing us to use their facilities to conduct this study.