THE EFFECTS OF ACUTE WHOLE-BODY VIBRATION ON MAXIMAL COUNTERMOVEMENT VERTICAL JUMP IN RECREATIONALLY ACTIVE MALES AND FEMALES

Sarah Hilgers and Bryan Christensen

Department of Health Nutrition and Exercise Sciences,
North Dakota State University, Fargo, ND, USA

KEYWORDS: countermovement vertical jump, whole-body vibration, body-weight squats

INTRODUCTION: Performance is a key factor in any type of training and competition, and even the smallest improvement can have a profound effect on the overall outcome. Some studies have shown that acute whole body vibration elicits a rapid increase in intra-muscular temperature and muscle contraction, thereby enhancing power, strength, and overall performance in the short-term (Cochrane, Stannard, Firth, & Rittweger, 2010). The purpose of this study was to examine the acute effects of three sets of 30 second body weight squats with and without whole-body vibration on maximal countermovement vertical jump in recreationally active males and females.

METHOD: Twenty-six recreationally active males and females, aged 18-23, participated in three days of testing with a minimum of 48 hours between each test-day. Recreationally active was defined as undergoing a minimum of 30 minutes of moderate-vigorous physical activity on three or more days per week. Descriptive demographics are listed in Table 1.

Table 1. Descriptive Demographics

Gender	N	Mean Age	Std.Dev Age	Mean Wt. (kg)	Std. Dev Wt.	Mean Ht. (cm)	Std. Dev. Ht.
Males	14	19.43	.938	75.88	7.67	182.61	6.10
Females	12	20.08	1.311	68.37	9.69	175.86	12.0

Day 1 of testing included baseline measurements consisting of a dynamic warm-up and maximal countermovement vertical jump test after one minute and five minutes of passive rest (standing). The countermovement vertical jump involved a jump and reach technique using a Vertec apparatus in which the individuals were given three trials to reach maximum jump height. The participants were then randomly assigned to the remaining two days of testing. Testing on Days 2 and 3 were identical with the exception that for half of the participants the vibration platform was turned off and for the other half of the participants the vibration platform was turned on. Those participants who completed the testing with the vibration platform turned on during Day 2, completed the testing with the vibration platform turned off during Day 3. Conversely, those participants who completed testing with the vibration turned off on Day 2, completed the testing with the vibration platform turned on during Day 3. All testing with the vibration platform turned on was completed with the vibration platform set at a frequency of 45 Hertz and high amplitude. 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) each followed by a maximal countermovement jump test. The 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 the 30 seconds for each set. A 30 second rest time was given between each set of body-weight squats, allowing for a 1:1 work to rest ratio.

A repeated measures ANOVA was performed to determine significant differences after the one minute and five minute rest periods. A t-test was performed as a follow-up analysis to examine any differences in jump height between the baseline, vibration and non-vibration conditions at both the one minute and five minute rest periods.

RESULTS: The Wilks' Lambda analysis of the repeated measures ANOVA displayed a significant difference at both the one minute ($p<0.001$) and five minute ($p<0.002$) rest periods. Mean jump height for each condition is as follows: Baseline 1 min: 56.42cm (SD=11.52cm); Vibration 1 min: 58.13cm (SD=12.45cm); Non-vibration 1 min: 58.52cm (SD=11.64cm); Baseline 5 min: 56.61cm (SD=11.36cm); Vibration 5 min: 58.32cm (SD=11.49cm); and Non-vibration 5 min: 57.83cm (SD=11.66cm). Results for the t-tests between conditions are listed in Table 2.

Table 2. T-test Results for vertical jump height in cm

Effect	Mean Diff.	Std. Dev	t	Sig. (2-tailed) .	Effect Size
Baseline 1min-Vibration 1 min	-1.7096	2.8724	-3.035	.006	.523
Baseline 1 min-Non-vibration 1 min	-2.0992	2.4851	-4.306	<.0001	.523
Vibration 1 min-Non-vibration 1 min	-.3896	2.4823	-.800	.431	.523
Baseline 5 min-Vibration 5 min	-1.7096	2.1535	-4.048	<.0001	.512
Baseline 5 min-Non-vibration 5 min	-1.2212	2.4225	-2.570	.017	.512
Vibration 5 min-Non-vibration 5 min	.4885	1.7626	1.413	.170	.512

DISCUSSION: Results of this study indicate that conducting body-weight squats, either with or without WBV, prior to performing a maximal power movement does have a significant improvement on vertical jump after both one minute and five minutes of passive rest. However, no significant differences were observed in jump height after body-weight squats with vibration compared to body-weight squats without vibration after either the one minute or five minute passive rest periods. Therefore, the motion of the squat may be a notable factor in performance rather than the addition of vibration to a training program or competition.

CONCLUSION: Although there were significant differences between baseline jump heights and body-weight squats both with and without WBV, no significant differences were observed between the vibration and non-vibration jump heights following either the one minute or five minute rest periods. This indicates that WBV may not provide enough muscle stimulation to have an impact on jump height, as previously suggested. Therefore, future research is needed to identify how WBV may be effective in improving jump performance.

REFERENCES:

Cochrane, D. J., Stannard, S. R., Firth, E. C., Rittweger, J. (2010). Acute whole-body vibration elicits post-activation potentiation. European Journal of Applied Physiology, 108, 311-319.

Acknowledgement

The researchers would like to thank all of those who volunteered for this study, and the NDSU wellness center for allowing us to use their facilities to conduct this study.