

Letter to Editor

Use of whole-body vibration as a mode of warming up before counter movement jump

Dear Editor-in-chief,

Whole-body vibration (WBV) has been suggested to be particularly effective on the stretch-shortening cycle-based movements, such as the counter movement jump (CMJ) test (Issurin, 2005). Nevertheless, the literature on short-term vibration exposure and lower limb explosive performance (measured by CMJ test) is contradictory. Either transient improvements (Bosco et al., 2000; Cochrane and Stannard, 2005; Torvinen et al., 2002a) or no effects (Torvinen et al., 2002b; Rittweger et al., 2003; Cormie et al., 2006) have been reported after a single WBV exposure ranging from 30 s to 10 min. The present study aimed at better characterizing the use of a single short bout of WBV as a mode of warming up before a CMJ test.

A total of 114 university students (37 men, 77 women, aged 19.6 ± 2.0 years) signed an informed consent form and volunteered to participate in the study. The study protocol was approved by the Review Committee for Research Involving Human Subjects of our center. Participants were asked to come to the laboratory in three occasions three days apart. First visit: familiarization session aiming to learn the CMJ technique and to experience the vibration stimulus. Second visit: the participants performed three consecutive CMJ with one min rest interval. No significant differences were observed among the jumps, and the highest score was retained. Third visit: the participants were exposed to a single short bout of WBV and immediately after they performed three CMJ with one min rest interval.

An infrared contact timing platform (ERGO JUMP Plus – BOSCO SYSTEM, Byomedic, S.C.P., Barcelona, Spain) was used to measure “flight” time (t) during the vertical jump (accuracy 0.001 s). Maximum height achieved by the body centre of gravity (h) was then estimated, i.e. $h = g \cdot t^2 / 8$, where $g = 9.81 \text{ m/s}^2$. In all occasions, the participants were instructed to abstain from strenuous exercise for the preceding 24 hours.

Whole-body vibration was carried out on an oscillating vibrating platform (Galileo 900, Novotec, Pforzheim, Germany). Since a suitable protocol of WBV has

not been definitely established (Cormie et al., 2006), participants were randomly allocated into five groups with different vibration protocols. The proportion of males (from 30.8 to 36.8 %) was similar in the five groups. Vibration amplitude was fixed at $\pm 3 \text{ mm}$ (i.e., peak-to-peak of 6 mm) for all groups, while frequency and duration ranged from 20 to 30 Hz and 90 or 120 s, respectively (Table 1). The time over the platform was equally distributed in three positions: 1st) isometric squat at a knee angle of approximately 120°, standing on the toes; 2nd) isometric squat at a knee angle of approximately 120°, standing on the whole foot; and 3rd) dynamic half squats (lower limit: 90° knee angle) at a fixed rhythm marked by a metronome (2.4 s per squat). Sport shoes were required during the entire vibration stimulus and all CMJ tests.

The interaction between sex, WBV protocol-group and CMJ performance was analysed by means of two-way repeated measures analysis of the variance (ANOVA). Since no significant interaction was found, males and females, as well as the five groups were analyzed together by repeated measured analysis of covariance (ANCOVA), with sex and WBV protocol-group as covariates. All the residuals showed a satisfactory pattern. Pairwise comparisons were performed with Bonferroni adjustment. The analysis was performed using the SPSS software v 15.0.1., and the level of significance was set at 5%.

The CMJ performance significantly decreased immediately after WBV was applied ($p < 0.001$). This decrease did not differ among the five WBV protocols used, and ranged between 1.1 cm for the 20 Hz - 90 s group and 2.7 cm for the 20 Hz - 120 s group. In the jumps performed one and two min after WBV, the performance was recovered up to the level achieved in the absence of WBV. Since the effect of the five different WBV protocols on CMJ performance did not significantly differ, the results are presented jointly (Figure 1).

Reports concerning acute effects of WBV on jump performance yield conflicting results. Transient benefits of 2.5, 4 and 8 % in CMJ height has been reported after 4 min (Torvinen et al., 2002a), 10 min (Bosco et al., 2000) and 5 min (Cochrane and Stannard, 2005) of WBV

Table 1. Characteristics of the study sample. Data are presented as mean (SD).

WBV protocol		20 Hz, 90 s (n = 19)	25 Hz, 90 s (n = 19)	30 Hz, 90 s (n = 26)	20 Hz, 120 s (n = 28)	25 Hz, 120 s (n = 22)
Age (years)	males	19.3 (.5)	20.6 (.7)	21.5 (.3)	19.3 (.5)	19.0 (.0)
	females	19.2 (.5)	19.4 (.8)	20.0 (.4)	19.4 (.9)	19.1 (.3)
Weight (kg)	males	76.9 (12.5)	77.0 (11.7)	78.0 (8.7)	80.2 (11.0)	73.6 (14.2)
	females	60.7 (6.1)	60.2 (9.2)	59.0 (5.1)	58.0 (9.0)	56.7 (7.8)
Height (m)	males	1.76 (.06)	1.72 (.08)	1.78 (.07)	1.79 (.06)	1.75 (.07)
	females	1.64 (.05)	1.63 (.05)	1.62 (.05)	1.64 (.07)	1.62 (.05)

WBV: whole-body vibration.

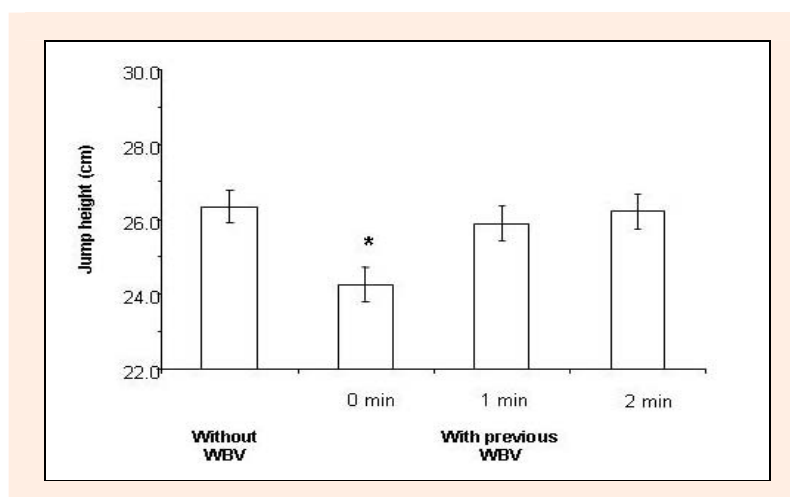


Figure 1. Effect of a single bout of WBV on counter movement jump performance. Data are expressed as mean \pm standard error of the mean. Since no significant interaction was found, males and females, as well as the five WBV protocol-groups, were analysed together.

* $p < 0.001$ for comparisons with all the other jumps.

stimulus, respectively. The lack of improvement in our study may be partially explained by the time elapsed between the vibration stimulus and the jump test, since our subjects performed the CMJ immediately after the WBV exposure. The different training level of the participants may also explain discrepancies among studies, as our subjects were not engaged in any regular exercise practice. It has been reported that elite athletes may obtain more benefits from WBV than amateur athletes do (Issurin and Tenenbaum, 1999).

In agreement with our results, other studies did not show improvement on CMJ performance after a single bout of WBV (Cormie et al., 2006; Rittweger et al., 2003; Torvinen et al., 2002b). Compared with our results, Cormie et al. (2006) did not find an impairment of CMJ performance immediately after a single WBV bout of 30 s, which may be associated with their shorter WBV stimulus (30 s), the interval actually elapsed between WBV and CMJ test, and the higher training level of their participants.

In summary, whole-body vibration combined with voluntary contractions does not seem to be a useful method for warming up before activities involving vertical jumps. At least one minute interval recovery should be allowed when using WBV in a range of 20–30 Hz and 90 or 120 s if maximal jump performance is required.

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