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Acute Effects of Whole-Body Vibration on Trunk and Neck Muscle Activity in Consideration of Different Vibration Loads

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ABSTRACT

The intention of this study was to systematically analyze the impact of biomechanical parameters in terms of different peak-to-peak displacements and knee angles on trunk and neck muscle activity during whole-body vibration (WBV). 28 healthy men and women (age 23 ± 3 years) performed four static squat positions (2 peak-to-peak displacements x 2 knee angles) on a side alternating vibration platform with and without vibration stimulus. Surface electromyography (EMG) was used to record the neuromuscular activity of the erector spinae muscle, the rectus abdominis muscle, and of the splenius muscle. EMG levels normalized to maximal voluntary contractions ranged between 3.2 - 27.2 % MVC during WBV. The increase in muscle activity caused by WBV was significant, particularly for the back muscles, which was up to 19.0 % MVC. The impact of the factor 'condition' (F-values ranged from 13.4 to 132.0, p ≤ 0.001) and of the factor 'peak-to-peak displacement' (F-values ranged from 6.4 to 69.0 and p-values from < 0.001 to 0.01) were statistically significant for each muscle tested. However, the factor 'knee angle' only affected the back muscles (F-value 10.3 and 7.3, p ≤ 0.01). The results of this study should give more information for developing effective and safe training protocols for WBV treatment of the upper body.

Key words: Vibration, electromyography, torso, paraspinal muscles

Key Points

- The maximum levels of muscle activity were significantly reached at high amplitudes at a vibration frequency of 30 Hz.
- WBV leads to a higher muscle activation of the lower back muscles than of the abdominal muscles.
- Both knee angles of 30° and 45° have similar effects on the vibration load and represent safe positions to prevent any actual harm.

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