ACUTE EFFECTS OF WHOLE BODY VIBRATION (WBV) ON CUTANEOUS PRESSURE SENSORS

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INTRODUCTION
WBV training machines have been largely used for rehabilitation or performance purpose. The effects of WBV machines on human body are still unclear with controversial results in the literature. Since cutaneous feedback from the feet is important for maintaining posture and balance control, the goal of this study was to investigate the response from mechanoreceptors for touch-pressure of the glabrous skin in response to a WBV session of 10 minutes of exposure.

METHODS
10 male and 10 female healthy subjects mean age of 25.3 (+2.6) years were invited to the Human Performance Laboratory of the University of Calgary for the measurements. None of them was used to train on vibration platforms. All procedures were in accordance with the Ethical Comittee of University of Calgary, protocol number 24334. WBV training was performed for 10 minutes on a vibration platform (TBS100A, Total Image Fitness, Inc.). The parameters settings (42Hz, 2mm amplitude and spiral mode) for the WBV exposure were chosen where people felt the highest sensation in lower leg and feet (determined with a pilot study prior to the experiment). Subjects were standing bare feet on a 3mm EVA foam with straight legs in an upright position. Pressure sensation was measured before the WBV exposure and 4 times after the WBV (immediately after, 1, 2 and 3 hours after the end of the WBV session). Pressure sensation was determined with Touch-Test™ 20 Piece Kit Semmes Weinstein monofilaments (58011, Stoelting Co.). The sensation was measured in 5 anatomical regions of the right foot (heel, medial arch, 1st and 5th metatarsal head and hallux). The filaments were numbered such that each number was equal to the log_{10} (10 x F[mg]). A modified 4, 2, 1 stepping algorithm [1], was used as a protocol. Furthermore, the temperature of the foot was measured before each measurement. Means and SE were calculated and the data were normalized to the control condition. Data were tested for normal distribution with Lilliefors test. Significance was determined with the Wilcoxon test due to the non-parametrical characteristics of the touch-pressure sensitivity data. The significance level of α=0.05 was Bonferroni corrected to α_b=0.05/5=0.01.

A half-life recovery time was calculated through an exponential regression line. Half-life was called the duration after the WBV in order to increase the sensation half way to the before condition.

RESULTS

The results for touch-pressure sensitivity showed a significantly decrease of the sensation directly after WBV. 4 regions (all except to the medial arch) remained reduced also 1 hour after WBV. Two and three hours after the WBV only the heel continued significantly different. The increase in force that had to be applied in order to feel the pressure increase was about 2 times from the baseline (control condition). The half-life was below one hour for 3 regions of the foot (Table 1). For the heel the half-life was 1.8 hour and for the hallux 1.5 hour.

DISCUSSION & CONCLUSIONS
Our findings showed a reduction for touch-pressure sensitivity after a short-term exposition to WBV that is for the 1st metatarsal head in agreement with the literature [2]. In addition to the existing literature we also recorded the recovery time for all five regions measured on the foot. In therapeutic interventions, when a hypersensitivity of the foot affects the exercise session because of pain, a reduction of sensitivity might be helpful. With the recovery time it might be possible to estimate the time window a therapeutic intervention can last.

REFERENCES

ACKNOWLEDGEMENTS
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Table 1: Half life recovery time [h] after 10 minutes WBV for 5 regions of the foot (Heel, 1st (I MET) and 5th (V MET) metatarsal head, medial arch (MED) and Hallux).

<table>
<thead>
<tr>
<th>Region</th>
<th>Half life</th>
<th>I MET</th>
<th>V MET</th>
<th>MED</th>
<th>Hallux</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heel</td>
<td>1.8 (±0.32)</td>
<td>0.7 (±0.18)</td>
<td>0.8 (±0.19)</td>
<td>1 (±0.31)</td>
<td>1.5 (±0.37)</td>
</tr>
<tr>
<td>1st metatarsal</td>
<td>3.0 (±0.5)</td>
<td>1.0 (±0.2)</td>
<td>1.2 (±0.3)</td>
<td>0.8 (±0.2)</td>
<td>2.1 (±0.4)</td>
</tr>
<tr>
<td>5th metatarsal</td>
<td>4.2 (±0.7)</td>
<td>2.4 (±0.5)</td>
<td>2.8 (±0.6)</td>
<td>2.0 (±0.4)</td>
<td>3.5 (±0.7)</td>
</tr>
<tr>
<td>Medial Arch</td>
<td>5.0 (±1.0)</td>
<td>3.0 (±0.6)</td>
<td>3.5 (±0.8)</td>
<td>2.5 (±0.7)</td>
<td>5.0 (±1.1)</td>
</tr>
<tr>
<td>Hallux</td>
<td>1.5 (±0.3)</td>
<td>0.75 (±0.15)</td>
<td>0.85 (±0.20)</td>
<td>0.65 (±0.15)</td>
<td>2.0 (±0.4)</td>
</tr>
</tbody>
</table>

Figure 1: Recovery time after 10 minutes WBV exposure for 5 anatomical regions of the foot. * α_b=0.01