Is the Acute and Short-Term Effect of Whole-Body Vibration the Same on the H-Reflex Recruitment Curve and Agility?

Morteza Ahmadi, Giti Torkaman, Sedigheh Kahrizi, Mojdeh Ghabaeae, and Leila Dadashi Arani

Context: Despite the widespread use of whole-body vibration (WBV), especially in recent years, its neurophysiological mechanism is still unclear and it is yet to be determined whether acute and short-term WBV exposure produce neurogenic enhancement for agility. Objective: To compare the acute and short-term effects of WBV on the H-reflex-recruitment curve and agility. Design: Cross-over study. Setting: Clinical electrophysiology laboratory. Participants: 20 nonathlete male volunteers (mean age 24.85 ± 3.03 y). Main Outcome Measures: Subjects were randomly divided into 2 groups, H-reflex and agility. In the sham protocol, subjects stood on the turned-off vibration plate while maintaining the semisquat position, and then, after a 2-wk washout, vibration-training sessions were performed in the same position with a frequency of 30 Hz and an amplitude of 3 mm. H-reflex-recruitment curve was recorded and the agility test of a shuttle run was performed before and after the first session and also 48 h after the 11th session in both sham and vibration-training protocols. Results: Acute effects of WBV training caused a significant decrease of threshold amplitude and H-max/M-max (P = .01 and P = .04, respectively). Short-term WBV training significantly decreased the threshold intensity of the soleus H-reflex-recruitment curve (P = .01) and caused a decrease and increase respectively, in the threshold intensity and the area under the recruitment curve. Conclusions: The results suggest an inhibitory effect of acute WBV training on the H-reflex response.

Keywords: exercise, motoneuron excitability, shuttle-run test, soleus

Whole-body vibration (WBV) is a training method that exposes the entire body to mechanical vibration as the individual stands in different positions on a vibrating platform. It has recently aroused interest because of its influence on muscle strength and body balance and also as a training tool in athletic settings. WBV has been described as producing gravitational acceleration changes similar to those of power and strength training. WBV imposes mechanical stimuli on the body and stimulates sensory receptors, most likely muscle spindles. These stimuli lead to activation of the alpha-motoneurons and initiate muscle contractions that are described as a tonic vibration reflex. Despite the widespread use of WBV in sports and rehabilitation, its neurophysiological mechanism is still unclear, and the results on the facilitatory or inhibitory effects of WBV vary widely between studies. To explain at least 1 aspect of the contradictory results, it has been proposed that the electrically evoked H-reflex might be differently affected by WBV. One of the best ways to investigate changes in the excitability of the spinal-reflex pathway is to record the H-reflex induced by electrical stimulation of the Ia fibers. The advantage of the H-reflex is that it bypasses the muscle spindles and more directly probes changes in motor neurons’ excitability and synaptic transmission. Apple et al investigated the acute effect of WBV on the H-reflex and showed that the amplitude of the H-reflex significantly decreased immediately after WBV but returned to baseline within 5 minutes after the intervention. Dadashi showed a reduction of H-reflex amplitude immediately after WBV that did not recover 10 minutes after WBV. Dadashi also showed suppression of the H-reflex while subjects maintained a semisquat position with a turned-off WBV.

Agility improvement after WBV training is a controversial issue in the research. Agility is of prime importance for many sports; however, it is poorly correlated with strength, power, and speed qualities that require specific motor and skill training. Therefore it is unlikely that WBV training will enhance agility performance unless the neural component for agility is greater than what we know. Most short-term WBV-training studies have focused on muscle-power aspects that involve stationary explosive movements using laboratory outcomes; less attention has been given to dynamic field-based sporting performance like sprinting. Several researchers have suggested that WBV can increase strength and power and enhance athletic performance. Some have speculated that this improvement in performance may be associated with an increased reflex activation. In contrast, Gunther and Thomas could not find any improvement in performance after WBV training. Cochrane et al investigated
short-term (9 sessions) effects of WBV training on agility performance in nonelite athletes and compared the WBV training group with the control (no-WBV) group. They found that there was no difference between the WBV and control groups and concluded that short-term WBV training did not enhance performance. Cochrane and Stannard found that acute WBV training increased vertical-jump performance in elite female hockey players. They suggested that acute WBV causes neural potentiation of the stretch-reflex loop, although they did not investigate the reflex loop. The relation between agility and the reflex loop is not clear, and, moreover, it seems that the effectiveness of the acute and short-term effects of WBV on agility and H-reflex response may be different. The aim of this study was to investigate the acute and short-term effects of WBV on the H-reflex-recruitment curve and agility performance in healthy young men.

Methods

Subjects

Twenty healthy young nonathlete men (age 24.85 ± 3.03 y, height 178 ± 5.40 cm, body mass 76.80 ± 7.03 kg) volunteered to participate in this study. There was no significant difference between groups in demographics, as shown in Table 1. Subjects were considered nonathletes if they did not participate in any regular (2 or 3 times per week) sports program. Inclusion criteria were no history of neurological and musculoskeletal disorders or cardiovascular disease, no lower-limb or back surgery, no diabetes, no kidney stones, no vestibular problems, no epilepsy, and no gallstones. Subjects were excluded if H-responses were not consistent (more than 10% of difference in peak-to-peak amplitude across 5 continuous recordings) in the first session, if they had any reluctance to participate in the study, or if they had any previous experience with WBV. At the first session the experimental procedures (testing and training) were explained precisely for the subjects and they provided written informed consent to participate in the experimental procedure.

Procedures

The WBV machine used in this study was Fit Vibe (Fitvib Medical, Uniphy Elektromedizin GmbH, Germany, with vertical oscillations). The amplitude and frequency of the vibration were set at 3 mm and 30 Hz, respectively. Subjects statically maintained a semisquat position with a knee-flexion angle of 25° to 30°. They were instructed to place their hands on the device handle, keeping the neck and head in flexion, and to distribute their weight equally on both feet. A manual goniometer was used to set the knee angle. To investigate the acute and short-term effects of WBV on the H-reflex-recruitment curve and agility, and because of the short period of the WBV acute effects (maximum up to a few minutes), subjects were randomly divided into 2 groups, H-reflex (HR) and agility (AG), and for this reason reflex and agility changes were investigated separately in these 2 groups. In each group, subjects participated in both sham and vibration protocols. First, they participated in the sham protocol (semisquat, standing on the turned-off WBV machine) for 11 sessions. After 2 weeks off (washout), they received the WBV-training protocol in the same semisquat position for 11 sessions. Training protocols (sham and vibration) consisted of 11 sessions (3 sessions/wk). In the first week, each session consisted of 4 sets of 1 minute, with 1 minute of rest between sets. Each week thereafter, 1 set was added to the training protocol, based on the progressive-overload principle. H-reflex-recruitment curve and assessment of time of the shuttle-run test were performed and recorded before and immediately after the first session (acute effect) and 48 hours after the eleventh session (short-term effect) in both sham and vibration protocols respectively, for the HR and AG groups. In the HR group, before and immediately after first session and then again 48 hours after the eleventh session, both in the sham and WBV training protocol, participants lay on a bed in a prone position with their feet off the edge of the bed. The temperature of the laboratory and also the temperature of the skin of the participant’s leg were constantly controlled with the digital thermometer to be in optimal temperature (32–34° C) for recording. To decrease skin impedance, the skin under the electrodes was shaved and cleaned using alcohol. The H-reflex was recorded from the soleus muscle. To record the H-reflex, we used a computer-controlled stimulator with an isolator (Nihon Kohden ss-104j, Japan) and a Neuro-MEP system (Neurosoft, Russia). A round surface recording electrode (Ag-AgCl) with 1 cm diameter was used. An active electrode was placed 2 cm distal to the insertion of the gastrocnemius muscle on the Achilles tendon and the reference electrode 2 cm further distally. The ground electrode was located between the stimulating and recording electrodes. Bandwidth frequency and sampling frequency were set at 5, 10, and 20 kHz, respectively. The stimulating electrode was a bar electrode 3 × 5.5 cm in size, with a 4-cm distance between cathode and anode, and it was fixed in the popliteal fossa between biceps femoris and no gallstones. Subjects were excluded if H-responses were not consistent (more than 10% of difference in peak-to-peak amplitude across 5 continuous recordings) in the first session, if they had any reluctance to participate in the study, or if they had any previous experience with WBV. At the first session the experimental procedures (testing and training) were explained precisely for the subjects and they provided written informed consent to participate in the experimental procedure.

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and semimembranosus tendons, tending slightly to the lateral. We used constant current stimulation, consisting of rectangular pulses with a duration of 0.2 millisecond and a frequency of 0.2 Hz, to prevent muscle fatigue. To obtain the H-reflex-recruitment curve for the soleus, 13 different stimulus intensities with 3 repetitions each were used. Stimulus intensities were set from below threshold level of the H-response to the required intensity to record maximum-H and consequently maximum-M response, M-max, and disappearance of H-response. These recordings are shown in Figure 1.

Recording data (different intensities and related H-reflex amplitudes) were processed using a custom-made LabVIEW-based program. After drawing the H-reflex-recruitment curve that is shown in Figure 2, the amplitude of the initial (threshold) and peak points of the recruitment curve and related intensities, the area under the curve and the ascending slope were defined. In addition, H/M and M-response during maximum H-response, Mh, were calculated.

In the AG group, before and immediately after the first session and 48 hours after the eleventh session, both in the sham and WBV-training protocol, participants were asked to perform a shuttle-run test. This test was a sprint of 4 x 10 m, and the time of test was recorded.

### Statistical Analysis

All statistical analysis was conducted using SPSS19 software. Normal distribution was shown with a Shapiro-Wilk test. To compare the differences between the sham and vibration protocols and also acute and short-term effects, a paired t test was used. All recording data in each session were normalized in relation to the data that were recorded before interventions (sham or vibration training). The sample size was determined by a sample-size estimation using the data from a previous study that examined the effects of WBV on motor-evoked-potential amplitude. The level of significance was set at \( P \leq .05 \).

### Results

#### Acute Effects of WBV

**HR Group.** After 1 session of the sham protocol, although the mean value of the ascending slope and the peak amplitude of the recruitment curve were reduced, the acute effect of the sham session had no significant effect on the parameters of the H-reflex-recruitment curve. Immediately after 1 session of WBV, the threshold amplitude of the soleus-recruitment curve and H-max/M-max significantly decreased by 54% and 14%, respectively (\( P = .01, P = .04 \)), as shown in Table 2. H-max/M-max showed a significant decrease after 1 session of WBV compared with the sham session (\( P = .01 \)).

**AG Group.** Immediately after 1 session of the sham and WBV, the time of the shuttle-run test was decreased, but this diminution was not significant in either session or between sham and WBV sessions (\( P > .05 \)), as shown in Table 3.

#### Short-Term Effect (11 Sessions) of WBV

**HR Group.** To detect the short-term effect of WBV on the parameters of the H-reflex-recruitment curve, those before the first session and 48 hours after the eleventh session of training were compared. Sham training significantly decreased (32%) the peak amplitude of the H-reflex-recruitment curve (\( P = .004 \)). The ascending slope of the soleus-recruitment curve decreased by 38%, but this diminution was not significant (\( P > .05 \)). After short-term WBV training, larger amplitudes with lesser electrical-stimulation intensities were obtained at the threshold and peak points of the H-reflex-recruitment curve. The intensity of the threshold point showed a significant decrease after short-term WBV training (\( P = .01 \)).

**AG Group.** After both short-term training protocols (sham and WBV), the time of shuttle-run test decreased nonsignificantly (see Table 5), and there was no significant difference between sham and WBV protocols.

### Discussion

The purpose of this study was to compare the acute (immediately after 1 session) and short-term (after 11 sessions) effects of WBV training on the H-reflex-recruitment curve of the soleus muscle and agility in healthy young men. To separate the effects of semisquat positioning, each group received a sham protocol (isometrically maintaining the semisquat position on the turned-off WBV plate) first, and then the training protocol was performed. The main finding was the suppression and facilitation of the H-reflex-recruitment curve in acute and short-term WBV protocols, respectively. The acute and short-term effects of WBV will be discussed separately.

#### Acute Effects of WBV

In the HR group, the acute effect of WBV training significantly decreased the amplitude of the threshold point in the H-reflex-recruitment curve and H-max/M-max. After 1 session of the sham protocol, no significant difference was observed; however, the peak amplitude of the H-reflex-recruitment curve decreased immediately after this session. Acute effects of WBV caused a decrease in H-max/M-max compared with the sham protocol. This finding confirms the inhibitory effect of acute WBV
Figure 1 — (a) Threshold, (b) peak, and (c) end amplitude of H-reflex and maximum Mwave.
Table 2  Parameters of the H-Reflex-Recruitment Curve in the Acute Protocol, Before and After 1 Session, Mean ± SD

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before 1st session (sham)</th>
<th>After 1st session (sham)</th>
<th>Before 1st session (WBV)</th>
<th>After 1st session (WBV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascending slope of the H-reflex-recruitment curve (mV/mA)</td>
<td>3.21 ± 3.12</td>
<td>3.13 ± 2.91</td>
<td>2.36 ± 2.03</td>
<td>2.13 ± 1.88</td>
</tr>
<tr>
<td>Area under the curve (mV·mA)</td>
<td>28.75 ± 15.16</td>
<td>32.67 ± 8.77</td>
<td>19.18 ± 11.86</td>
<td>20.86 ± 13.47</td>
</tr>
<tr>
<td>Threshold amplitude (mV)</td>
<td>0.33 ± 0.16</td>
<td>0.26 ± 0.32</td>
<td>0.31 ± 0.29</td>
<td>0.14 ± 0.09*</td>
</tr>
<tr>
<td>Threshold intensity (mA)</td>
<td>6.44 ± 1.23</td>
<td>6.48 ± 1.22</td>
<td>6.19 ± 0.99</td>
<td>6.15 ± 0.98</td>
</tr>
<tr>
<td>Peak amplitude (mV)</td>
<td>7.23 ± 4.20</td>
<td>7.14 ± 3.78</td>
<td>5.08 ± 3.35</td>
<td>5.17 ± 3.32</td>
</tr>
<tr>
<td>Peak intensity (mA)</td>
<td>9.81 ± 2.27</td>
<td>9.28 ± 1.84</td>
<td>9.19 ± 2.08</td>
<td>9.40 ± 2.27</td>
</tr>
<tr>
<td>Mh peak amplitude (mV)</td>
<td>1.35 ± 1.01</td>
<td>1.07 ± 0.60</td>
<td>1.42 ± 1.07</td>
<td>1.33 ± 0.96</td>
</tr>
<tr>
<td>H-max/M-max</td>
<td>0.55 ± 0.26</td>
<td>0.63 ± 0.27</td>
<td>0.57 ± 0.23</td>
<td>0.49 ± 0.23*</td>
</tr>
</tbody>
</table>

Abbreviation: WBV, whole-body vibration.
*Significant difference between before and after 1 session of WBV.

Table 3  Time of the Shuttle-Run Test in Acute Protocols, Before and After 1 Session, Mean ± SD

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before 1st session (sham)</th>
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<th>Before 1st session (WBV)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Time of shuttle-run test (ms)</td>
<td>1.09 ± 10.68</td>
<td>1.12 ± 10.59</td>
<td>0.81 ± 10.21</td>
<td>0.84 ± 10.13</td>
</tr>
</tbody>
</table>

Abbreviation: WBV, whole-body vibration.

Training. Dadashi11 showed reflex inhibition immediately after 1 session of WBV training that 10 minutes after WBV had not recovered. Apple et al10 investigated the acute effects of WBV on the H-reflex and ankle range of motion and found that amplitude of the H-reflex significantly decreased after WBV training, but it returned to baseline 5 minutes after training. Another finding of the current study is the nonsignificant reduction of Mh amplitude, which is an orthodromic muscle response due to stimulated motor axons of the tibial nerve after the acute.
The Acute Effect of Whole-Body Vibration

The acute effect of WBV. H-max/M-max is, as an index of motor-neuron excitability, significantly decreased after an acute bout of WBV, so it seems that the acute effects of WBV inhibit the H-reflex. Armstrong et al.19 and Sayenko et al.20 reported a depression of the soleus H-reflex immediately after WBV. Maffiuletti et al.21 stated that WBV can induce neuromuscular fatigue. One of the potential mechanisms responsible for the reduction of Ia afferent transmission could be postactivation depression (PAD). PAD reflects a reduced Ia afferent transmitter release because of previous activation.22 The repetitive excitations of Ia fibers via WBV (30 Hz in this study) cause a transmitter depletion in the presynaptic terminals and, consequently, a reduced postsynaptic excitation. Considering that, after WBV, we record many H-responses fitting the recruitment curve and that PAD lasts for only 10 seconds,22 it seems that PAD cannot completely explain the observed suppression effect in this study. It may be speculated that presynaptic inhibition has also contributed to the observed H-reflex reduction immediately after WBV.23 Another suggested mechanism is reciprocal inhibition, but WBV was shown to cause a cocontraction and reciprocal inhibition is thought to be reduced during cocontraction; thus, this mechanism cannot suppress the Ia afferent transmission.24

Table 4  Parameters of the H-Reflex-Recruitment Curve in Short-Term Training Protocols, Mean ± SD

<table>
<thead>
<tr>
<th>Variable</th>
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<th>After (sham)</th>
<th>Before (WBV)</th>
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<tbody>
<tr>
<td>Ascending slope of the H-reflex-recruitment curve (mV/mA)</td>
<td>3.21 ± 3.12</td>
<td>1.99 ± 1.50</td>
<td>2.28 ± 1.62</td>
<td>2.45 ± 2.47</td>
</tr>
<tr>
<td>Area under the curve (mV·mA)</td>
<td>28.75 ± 15.16</td>
<td>18.72 ± 14.74</td>
<td>19.18 ± 11.86</td>
<td>24.93 ± 19.61</td>
</tr>
<tr>
<td>Threshold amplitude (mV)</td>
<td>0.16 ± 0.33</td>
<td>0.26 ± 0.33</td>
<td>0.32 ± 0.29</td>
<td>0.35 ± 0.34</td>
</tr>
<tr>
<td>Threshold intensity (mA)</td>
<td>6.44 ± 1.23</td>
<td>6.47 ± 1.18</td>
<td>6.85 ± 1.30</td>
<td>5.91 ± 1.09*</td>
</tr>
<tr>
<td>Peak amplitude (mV)</td>
<td>7.23 ± 4.20</td>
<td>4.59 ± 2.94*</td>
<td>5.15 ± 3.15</td>
<td>5.92 ± 3.92</td>
</tr>
<tr>
<td>Peak intensity (mA)</td>
<td>9.81 ± 2.27</td>
<td>9.67 ± 2.54</td>
<td>9.46 ± 1.85</td>
<td>8.93 ± 2.37</td>
</tr>
<tr>
<td>Mh peak amplitude (mV)</td>
<td>1.35 ± 1.01</td>
<td>1.08 ± 1.03</td>
<td>1.34 ± 1.13</td>
<td>1.50 ± 1.06</td>
</tr>
<tr>
<td>H-max/M-max</td>
<td>0.57 ± 0.26</td>
<td>0.82 ± 0.70</td>
<td>0.53 ± 0.21</td>
<td>0.87 ± 0.83</td>
</tr>
</tbody>
</table>

*Significant difference compared with before training in each protocol (P < .05).

Figure 3 — Percentage changes of the threshold intensity and the area under the recruitment curve in the sham and whole-body-vibration (WBV) training protocols, mean ± SE. *Significant difference between sham and WBV (P < .05).

Table 5  Time of the Shuttle-Run Test in Short-Term Protocols (Sham and WBV), Mean ± SD

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before (sham)</th>
<th>After (sham)</th>
<th>Before (WBV)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Time of shuttle run (ms)</td>
<td>1.08 ± 10.86</td>
<td>1.14 ± 10.50*</td>
<td>0.77 ± 10.36</td>
<td>0.83 ± 10.10*</td>
</tr>
</tbody>
</table>

Abbreviation: WBV, whole-body vibration.

*Significant difference compared with before training in each protocol (P < .05).
In the AG group, the time of the shuttle run test showed no significant difference between sham and vibration sessions. Acute effects of sham and WBV protocols also decreased the time of the shuttle-run test; however, this diminution was not significant. Some researchers stated that WBV can increase performance. Cochrane and Stannard showed that immediately after WBV training jump height and flexibility were improved and claimed that this improvement was the result of facilitation of the reflex loop. They did not record the reflex responses and just suggested that this improvement was due to reflex facilitation. The current study detected reflex inhibition immediately after WBV, and it seems that the improvement in the agility test cannot be related to reflex facilitation. As mentioned earlier, for agility measuring, we used the shuttle-run (4 × 10-m sprint) test. This test is used by many coaches to assess performance in athletes. Roberts et al showed that the acute effects of WBV on sprint starts was not different from a control group (no WBV) in nonelite college athletes. Cochrane and Stannard reported improved performances in countermovement-jump tests in elite female field hockey players after acute WBV training; they stated that acute WBV causes neural potentiation of the stretch-reflex loop and increases muscle temperature, which can improve performance, but they did not investigate any reflex loops. It is noteworthy that the test that was used in this research was the countermovement jump, which can stimulate the stretch-shortening cycle of the muscle and cause better performance and agility, and this kind of test can interfere with WBV’s effect. Based on the present data, the acute WBV had a suppressive effect on the H-reflex and no significant change in shuttle run time; of course, this test is dependent on some peripheral and central factors that affect the obtained results. Some of these factors include the increase of muscle-spindle sensitivity and an increase in muscle circulation and temperature, which should be considered in future studies.

Short-Term Effect of WBV

After short-term WBV training, the threshold intensity of the H-reflex-recruitment curve significantly decreased. Amplitude of the threshold and peak points, ascending slope, H-max/M-max, and the area under the curve showed nonsignificant increases after short-term WBV training that may be due to facilitation of the H-reflex loop. In contrast to the acute effects of WBV, short-term training of WBV caused a decrease and increase, respectively, in the threshold intensity and area under the curve compared with sham training. It seems that in the short term, WBV causes potentiation and stimulation of muscle spindles and the increase of spatial recruitment causes reflex activation of motor neurons. In the short-term sham training protocol, the peak amplitude of the H-reflex-recruitment curve was significantly decreased. It seems that the short-term sham training had suppressive effects on the H-reflex. The threshold intensity of the recruitment curve increased after short-term sham training; although this diminution was not significant, it may indicate fatigue occurring during the maintenance of the static position in this protocol. de Ruiter observed that the amplitude of the H-reflex was reduced immediately after fatiguing exercise and suggested that fatigue can affect motor-neuron excitability. In this relationship, amplitude of M response was also reduced (11.8%), which may confirm the occurrence of fatigue. Dadashi showed the suppression of H-reflex with maintaining a semisquat position on the turned-off WBV and suggested that active control mechanisms such as extensor-muscle contraction can inhibit reflex activity. Another mechanism that may explain this suppression effect is the soleus muscle length (static-stretch position) in the semisquat position, which can decrease the Ia afferent discharges and inhibit the H-reflex response. The significant difference in the threshold intensity and total area of recruitment curve in the short-term WBV training compared with the short-term sham protocol can confirm the excitability effect of WBV training that suppresses the inhibitory effect of maintaining the static semisquat position. In contrast to the acute effects of WBV, its short-term effects may reduce presynaptic inhibition and increase neuromuscular potentiation, but determination of the details about the segmental/suprasegmental mechanisms should be investigated in future studies.

After short-term WBV training, no significant difference was shown in the time of the shuttle-run test compared with sham protocol. Cochrane et al compared the effects of short-term (9 sessions) WBV training and no WBV training (control group) on jump height, sprint, and agility in nonelite athlete and reported that there was no difference between WBV and sham groups. de Ruiter et al showed that 11 weeks of WBV training did not improve agility performance (jump height) in healthy young people. Increased performance after WBV may be due to potentiation at the motor-neuron pool and an increase of Ia afferent efficiency. With potentiation, WBV causes an increase in force, velocity, and power in maximum contractions. Agility tests are a complex function, and many factors can affect their results, including neuromuscular coordination, central and peripheral nervous system feasibility, learning, skill, and other individual factors. On the other hand, it seems that this test is a general test and cannot be considered a specific test to show the sole effect of WBV.

In conclusion, the acute effects of WBV training caused suppression of Ia afferents and inhibition of the H-reflex response, and short-term effects of WBV included facilitation of the H-reflex activity. Acute and short-term effects of sham (semisquat) training caused inhibition of the H-reflex response. It seems that the short-term effect of WBV can facilitate the H-reflex response that may be effective to increase the muscle activity, muscle performance, and existing strength in patients and athletes. However, the effects of WBV on power, strength, and muscle performance should be investigated using special methods.
Conclusion

Based on our study results, in contrast to the acute effects of WBV, its short-term effects can facilitate the H-reflex response, and it may be effective for increasing motoneuron excitability. This effect can be investigated in future studies to determine the application or effectiveness of WBV in sport and clinical use.

Acknowledgments

All subjects provided written informed consent to participate in the experimental procedure, which approved by the ethics committee of Tarbiat Modares University. This study was accomplished in clinical electrophysiology laboratory of medical faculty and was funded by a grant from the postgraduate studies and research program, physical therapy department at Tarbiat Modares University, Tehran, Iran.

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