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By Chantal A. Vella, PhD

whole-body vibration training

Shake up clients' workouts with this low-impact training method.

No pain, no gain? This popular adage may not ring true for whole-body vibration (WBV), a new training method that has been used widely in Europe. WBV training has been shown to increase muscular strength, explosive power and anabolic hormone levels when performed for as little as 4 minutes three times a week (Bosco et al. 2000; Torvinen et al. 2002). It requires relatively little exertion compared with traditional forms of exercise; yet studies comparing this training method to traditional strength training have found similar gains in strength and, in some cases, more gains in explosive power (Delecluse, Roelants & Verschueren 2003; Roelants et al. 2004). Since WBV is low impact, it may be a particularly good choice for older or obese clients who have trouble doing traditional weight-bearing exercise.

vibration training equipment

WBV training can be accomplished in several different ways, but unfortunately it cannot be achieved without machinery. The equipment used in most research studies is the vibration platform. Several companies make these platforms. Although they are expensive (ranging from $1,500 to $10,000), the benefits to your clients may be worth the cost. WBV training can also be accomplished by using vibrating dumbbells or custom-made vibrating machines that attach to equipment cables. Here are some of the products available:

- VibraSlim® V2 Platform
- Galileo™ handheld dumbbell
- Galileo™ 2000 platform
- NEMES™ platform (Neuro-Mechanical Stimulator)
- Power Plate™ platform
- Smitech Vibratech VT-2000 platform

What Is WBV?

WBV is a neuromuscular training method that uses a low- to moderate-vibration stimulus to improve muscular strength and power. During the most frequently used mode of WBV training, a client stands on a vibrating platform and performs unloaded exercises, such as squats or lunges, for durations ranging from multiple 1-minute sessions to continuous 30-minute sessions.

The WBV platform produces oscillating vibrations that are delivered to the entire body. The vibrations are set at a frequency and amplitude that will provide a desired stimulus. Frequency, measured in hertz (Hz), refers to the number of vibrations per second; at 25 Hz, the targeted muscles receive 25 cycles of vibration per second, which makes them contract and relax 25 times in the same period. Amplitude, measured in millimeters (mm), refers to the extent of the vertical displacement of the platform during vibration. Higher frequencies and amplitudes increase the intensity of the vibrations. When an individual stands on the platform, the lower body receives the greatest vibration stimulus; the vibration lessens as it moves up the body.

How Does WBV Work?

The current theory is that WBV stimulates the body's natural stretch reflex and causes muscle contractions in much the same way that a doctor's tapping below a patient's patella with a reflex hammer elicits a knee-jerk response. The stretch reflex is controlled by stretch receptors called *muscle spindles* that are located in skeletal muscle. Muscle spindles are usually activated when a muscle is under a static stretch or is quickly stretched or overstretched, causing a reflex contraction of the muscle. With WBV, this reflex action is continually stimulated, so a muscle continues to contract and relax until the vibration stops. In addition, studies have reported that activation of one muscle spindle will cause a reflex contraction and relaxation in many adjacent muscles (Issurin & Tenenbaum 1999; Cardinale & Lim 2003).

Muscle spindles work by activating motor neurons (nerves) in the spinal cord; these neurons initiate movement by sending signals from the brain to the muscles. Voluntary activation of motor neurons is a limiting factor in muscular force production. The improvements in muscular force production with WBV are a direct result of increased motor neuron activation by muscle spindles, leading to increased motor unit recruitment and force production. WBV stimulates fast-twitch (type 2) motor units, which are usually recruited during high-intensity, explosive movements or whenever slow-twitch (type 1) motor units are maximally recruited. As a result, long-term, exhaustive exposure to WBV can lead to muscular fatigue and muscle soreness.

Long-Term Effects of WBV Training

The majority of studies suggest that WBV training is just as effective as resistance training in eliciting gains in muscular strength and power. In fact, some findings suggest that WBV training may be more effective than resistance training if the desired result is an increase in power, since WBV training stimulates those hard-to-recruit fast-twitch motor units.

In the only placebo-controlled study, Delecluse and colleagues (2003) reported significant increases in isometric, dynamic and explosive strength (power) in young, healthy females following 12 weeks of WBV training. Subjects were placed into three groups: (1) WBV, (2) resistance

training (RES) and (3) placebo (PLA). The WBV group performed static and dynamic knee extension exercises (squats, deep squats, wide-stance squats, one-legged squats and lunges) on the vibration platform (frequency: 35–40 Hz; amplitude: 2.5–5 mm) three times a week. Over the 12-week period, overload was accomplished by increasing the duration of vibration from 3 minutes to 20 minutes per session, increasing the number of repetitions per exercise, shortening the rest periods or increasing the frequency and/or amplitude of the vibration. The PLA group performed the same exercises on the vibration platform; however, the platform was set at a negligible frequency and amplitude. The RES group performed a moderate resistance training program for knee extensors on a leg press and leg extension machine. Like the WBV program, the RES program was slowly progressive. Findings revealed that isometric and dynamic knee extensor strength increased significantly in both the WBV group (9% and 16%, respectively) and the RES group (7% and 14.4%, respectively). The PLA group did not show an increase in either isometric or dynamic strength. Additionally, explosive strength increased by 7.6% in the WBV group, the only group to show a significant increase. These findings suggest that WBV training may be just as effective as resistance training for gaining muscular strength and may be superior to resistance training for increasing muscular power.

In a similar study, Roelants et al. (2004) reported a significant increase in fat-free mass and strength with WBV. This study compared the effects of 24 weeks of resistance training and WBV (frequency: 35–40 Hz; amplitude: 2.5–5 mm) on body composition and knee extensor strength in untrained young women. Although there were no significant changes in body weight or percent body fat in either group, the WBV group significantly increased fat-free mass (by 2.2%). A significant increase in knee extensor strength was also reported in both groups.

In another study, conducted by Roelants, Delecluse and Verschueren (2004), 24 weeks of WBV training performed three times a week increased dynamic knee extensor strength in postmenopausal women by 15%. This strength increase was similar to the increase reported in the resistance-trained group. Speed of movement of the knee extensors was significantly increased *only* in the WBV group, further supporting the concept that WBV may be superior to resistance training for increasing power, as a large determinant of muscular power is speed of movement.

Torvinen and colleagues (2002) also reported significant results. In this study, young, healthy males and females performed 4 minutes of unloaded exercises on a vibration platform three to five times per week for 4 months (frequency: 25–40 Hz; amplitude: 2 mm). During each 4-minute vibration exposure, vibration frequency was increased progressively in 1-minute intervals. Vertical jump height increased 8.5% and knee extensor strength increased 2.5% in the WBV group. No improvements were reported in the control group. The authors concluded that performing unloaded exercises on a

sample progressive training program

The following program can be used with healthy sedentary or trained clients. If a client has trouble adjusting to the vibration, the frequency and amplitude can be decreased to a level that feels comfortable. Studies have shown that a frequency as low as 20 Hz and an amplitude of 2 mm can elicit positive results (Cardinale & Lim 2003; Rittweger et al. 2002). Obese and elderly clients can start by simply standing on the platform with their knees slightly flexed. When they feel comfortable, they can progress to more difficult movements, such as alternating body weight from one leg to another.

Choose 3–6 of the following exercises for each training session. Exercises should be unloaded and performed with slow, controlled movements. (Athletes can increase intensity by wearing a weight belt while performing the exercises.)

- standing with knees slightly flexed
- squat
- deep squat
- wide-stance squat
- one-legged squat
- lunge

Week	Days/ Week	Intervals for Each Exercise	Duration of Interval	Rest Period	Frequency (Hz)	Amplitude (mm)
1	3	2	1 minute	1 minute	25	2
2	3	2	2 minutes	1 minute	25	2
3	3	2	2 minutes	1 minute	30	2
4	3–5	2	2 minutes	30 seconds	30	2.5
5	3–5	3	2 minutes	30 seconds	35	2.5
6+	3–5	3–5	2 minutes	30 seconds	35–40	2.5–3.0

vibration platform for only 4 minutes per day can increase muscular strength and power in healthy individuals.

Acute Effects of WBV Training

WBV has also been reported to produce immediate effects on anabolic hormone levels and muscular power. Bosco and colleagues (2000) noted a significant increase in blood concentrations of testosterone and growth hormone following 10 one-minute sessions of WBV training (frequency: 26 Hz; amplitude: 4 mm) in healthy men. WBV training also elicited a decrease in the blood concentration of cortisol, the body's stress hormone, suggesting that WBV does not produce a general stress reaction, a response that is common for high-intensity exercise.

In another study, Issurin & Tenenbaum (1999) reported significant increases in maximal power following vibration stimulus during bilateral biceps curls in elite and amateur athletes. Each subject performed two separate series of three sets of bilateral biceps exercises. In the second set of one series, a vibration stimulus was delivered to the subjects by means of vibrating cables (frequency: 44 Hz; amplitude: 3 mm). Both elite and amateur athletes showed improvement—10.4% and 7.9% respectively—in maximal power following vibration exposure.

The above findings indicate that WBV can elicit immediate improvements in muscle function and hormone production. However, the lasting effect of these acute responses has yet to be tested.

WBV & Osteoporosis

Osteoporosis, a condition characterized by the progressive loss of bone tissue, is one of the most common complications of aging. After menopause, bone mineral density (BMD) can decline at a rate as high as 3% per year in some women (Rubin et al. 2004). A handful of research studies have reported positive effects of WBV training on BMD in postmenopausal women. In a 24-week study (Verschueren et al. 2004), hip BMD showed a significant increase of 0.93% in postmenopausal women who participated in WBV three times a week. In a 12-month study (Rubin et al. 2004), WBV training effectively prevented bone loss in the spine and femur in postmenopausal women, whereas the placebo group lost 1.6% and 2.13% of spine and femur BMD, respectively. Although no studies to date have compared the bone benefits of WBV training to those of resistance training, current studies reveal that WBV may be an effective intervention for the prevention of osteoporosis.

Practical Applications

WBV is a fast, effective alternative to resistance training that enhances muscular strength and power in both sedentary and athletic populations. The low-impact nature of the exercise and the relatively low exertion required make WBV an attractive exercise mode when working with obese and elderly clients. Additionally, it can be a good cross-training option for athletes wishing to minimize the amount of repetitive joint loading on their bodies.

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