

Whole-Body-Vibration Training Effective in Older Women

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June 18, 2004 — Whole-body-vibration (WBV) training is as efficient as standard resistance (RES) training for improving strength and speed in older women, according to the results of a randomized trial published in the June issue of the *Journal of the American Geriatric Society*.

"Recently, WBV training has been promoted as an efficient alternative for resistance training," write Machteld Roelants, MS, from Katholieke Universiteit in Leuven, Belgium, and colleagues. "Even if performed to exhaustion, the increases in heart rate, blood pressure, and oxygen uptake during WBV are mild, so the cardiovascular risks of WBV in older adults are negligible."

In this controlled trial at the Exercise Physiology and Biomechanics Laboratory in Leuven, 89 postmenopausal women were randomized to WBV training, RES training, or to a control group that did not participate in any training. All women were not receiving hormone replacement therapy (HRT), and age range was 58 to 74 years.

Both active intervention groups trained three times a week for 24 weeks. The WBV group performed unloaded static and dynamic knee-extensor exercises on a vibration platform, which provokes reflexive muscle activity. The RES group performed dynamic leg-press and leg-extension exercises, increasing from low (20 repetitions maximum) to high (8 repetitions maximum) resistance, to train knee extensors.

A motor-driven dynamometer measured isometric strength and dynamic strength, speed of movement was measured using an external resistance equivalent to 1%, 20%, 40%, and 60% of isometric maximum, and countermovement jump performance was determined using a contact mat.

After 24 weeks of training, isometric and dynamic knee-extensor strength increased significantly in both groups ($P < .001$ vs. baseline), and the training effects were similar in both groups ($P = .56$). Isometric and dynamic knee-extensor strength were $15.0\% \pm 2.1\%$ and $16.1\% \pm 3.1\%$, respectively, in the WBV group, and $18.4\% \pm 2.8\%$ and $13.9\% \pm 2.7\%$, respectively, in the RES group.

After 24 weeks of training, speed of movement of knee extension significantly increased at low resistance (1% or 20% of isometric maximum) to $7.4\% \pm 1.8\%$ and $6.3\% \pm 2.0\%$, respectively, in the WBV group only. There were no significant differences in training effect between the WBV and the RES groups ($P = .39$ and $P = .14$, respectively).

Countermovement jump height improved from baseline ($P < .001$) after 24 weeks of training in the WBV group ($19.4\% \pm 2.8\%$) and the RES group ($12.9\% \pm 2.9\%$). Most of

the improvement in knee-extension strength, speed of movement, and in countermovement jump performance occurred after 12 weeks of training.

"WBV is a suitable training method and is as efficient as conventional resistance training to improve knee-extension strength and speed of movement and countermovement jump performance in older women," the authors write. "As previously shown in young women, it is suggested that the strength gain in older women is mainly due to the vibration stimulus and not only to the unloaded exercises performed on the WBV platform."

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Learning Objectives for This Educational Activity

Upon completion of this activity, participants will be able to:

- Describe features of WBV training.
- Compare effects of WBV training with RES training on knee-extension strength and movement in older women.

Clinical Context

Age-related decrease in physical activity and reduction in sex hormones are linked to strength loss and muscle atrophy. The latter predispose elderly women to falls and fractures with subsequent morbidity and mortality. WBV consists of standing unloaded on a platform generating vertical sinusoidal vibration at a frequency of 2.5 to 40 Hz with amplitudes of 2.0 to 10.5 mm transmitted to the body to stimulate sensory receptors such as muscle spindles. Unloaded exercise is performed on the platform. Tonic vibration is believed to facilitate activation of high-threshold motor units affecting fast-twitch fibers, which play a role in muscle strength and power. The major part of the gain in strength is believed to be due to muscle activity provoked by vibration.

One study by Delecluse and colleagues published in the June 2003 issue of *Medicine and Science in Sports and Exercise* showed increased isometric and dynamic knee-extensor strength of 16.6% and 9.0%, respectively, in previously untrained young women. WBV has the potential to enhance muscular performance in older adults who are unwilling or unable to perform standard RES exercises.

This is the first randomized study to investigate long-term (24 weeks) effects of WBV training on muscle strength, measured as knee-extension isometric, dynamic strength and speed in postmenopausal women not receiving HRT and to compare these effects with similar standard RES training.

Study Highlights

- Inclusion criteria were postmenopausal women not receiving HRT and not engaged in regular organized physical activities.

- Exclusion criteria were metabolic or neuromuscular disease, osteoporosis, osteoarthritis, orthopedic injuries, or two or more cardiovascular risk factors.
- 89 women were randomized to a WBV group (n = 30), a RES group (n = 30), and a control group (n = 29) with no exercise program. 69 women completed the program (n = 24, 20, and 25 for the 3 groups, respectively) and were included in the analysis.
- The study was powered at 80% with an α of .05 to detect a difference between the training and control groups assuming a dropout rate of around 30%.
- Baseline assessment included complete medical examination, ergometer test for maximal exercise capacity, and modified Baecke Questionnaire for Elderly to document baseline activity level.
- The 2 training programs consisted of seventy-two 30-minute sessions for 24 weeks. Training frequency was 3 times a week with at least one rest day between sessions.
- The WBV group performed a supervised total-body training program with high, deep, and wide-stance squats and lunges with warm-up and cool down. Training volume was increased by extending the duration of the vibrations. Training intensity was progressively increased by reducing rest periods or increasing the amplitude or frequency of vibrations.
- The RES group performed cardiovascular exercises with increasing resistance for leg extensions and leg presses under supervision from instructors. Repetitions were increased using the American College of Sports Medicine guidelines for individuals older than 60 years.
- Outcomes (comparing baseline to 12 and 24 weeks) were percentage changes in strength of knee extensors, dynamometry for isometric and dynamic knee strength and speed, maximal strength, speed of movement, and countermovement jump performance.
- Participants in the 3 groups were similar for age (64 years), weight (66-70 kg.), and body mass index (26 kg/m²). The 69 who completed the program attended all 72 sessions.
- Isometric and dynamic knee strength increased significantly ($P < .001$) in the WBV group (mean, 15.0%) and the RES group (18.4%) compared with no change in the control group, after 24 weeks of training. There was no significant difference between the two groups ($P = .56$).
- Speed of movement of knee extension significantly increased at low resistance in the WBV and RES groups after 24 weeks of training compared with the control group which showed no improvement from baseline. Improvements in speed of movement were greater in the WBV than the RES group at low resistances of 1% and 20%.
- Countermovement jump height enhanced significantly ($P < .001$) in the WBV group (19.4%) and the RES group (12.9%) after 24 weeks.
- Most of the gain in knee-extension strength and speed of movement and in countermovement jump performance were realized after 12 weeks of training.
- Reasons for dropout before 24 weeks included incompatibility of training program with lifestyle, mild knee discomfort, and health problems unrelated to the programs. 3 participants dropped out because of anterior knee pain

(patellofemoral dysfunction and patellar tendinopathy) associated with the training program.

Pearls for Practice

- WBV is a safe, appropriate, and efficient strength-training method that can be applied in geriatric settings as a low-impact exercise program.
- Regular WBV training three times weekly for 24 weeks in postmenopausal women not receiving HRT significantly improved knee-extension isometric strength, dynamic strength, and speed of movement at levels comparable to similar RES training.