

Whole Body Vibration: A Revolutionary Mode of Exercise or A Trend?

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Whole-body vibration (WBV) has received a lot of attention as an effective exercise modality in sports and rehabilitation settings during the last decades [1,2]. Many health centres promoted WBV exercise as an innovative mode of exercise that requires less volitional input and may replace traditional resistance exercise. More specifically, WBV exercise has gained popularity as an alternative less fatiguing and less time-consuming mode of exercise for improving different features of physical fitness and health. WBV has also been marketed, by many companies, as a suitable weight-loss and body toning workout, demonstrating that 10 min of WBV exercise is equal to 1 h of traditional resistance exercise [3]. However, the important question is: 'Has WBV exercise the ability to improve various indices of health, overall fitness and functional capacity, as previously purported by the lay literature?'

WBV is a mechanical stimulus characterized by oscillatory motion [1]. During WBV exercise, mechanical stimuli are transferred from the feet to the rest of the body by use of vibrating platforms [2,4]. The potential mechanisms that might explain the possible beneficial effects of WBV on neuromuscular performance comprise hormonal factors, the activation of the "tonic vibration reflex", and alterations in proprioceptors discharge [5]. The WBV loading parameters include frequency (the repetition rate of the cycles of oscillation, in Hz), amplitude (the extent of the oscillatory motion, in mm) and duration [1]. The interaction of frequency and amplitude determine the WBV acceleration (in m/s^2), and their different combinations determine the training load [6,7].

The effects of WBV training on fitness parameters are influenced by the subject's characteristics (age, gender, training and health status) and by the vibration training characteristics (e.g. vibration frequency and amplitude, duration, training frequency, body position) [8]. An additional important factor that could influence the efficacy of WBV exercise on the human body is the mode of vibration (vertical simultaneous vs. side to side alternating movement) [8]. Indeed, there is evidence that side-to-side WBV platforms: a) may induce a different degree of muscle stretch and tissue vibration in leg muscles leading to different neuromuscular adaptations [9], b) evoke greater heart rate responses [10] and c) transfer less mechanical energy to the head and neck of the human body in relation to vertical simultaneous platforms [9], and thus, are considered safer for untrained individuals as well as for individuals with chronic diseases.

It should be mentioned that WBV may provoke harmful effects on the human body when is used inappropriately [2]. The attitudes concerning the appropriate use of WBV exercise in healthy and clinical populations are divergent. Although, WBV is not recommended as an efficient training modality in people with acute inflammation as well as with acute cardiovascular and musculoskeletal conditions; however, its therapeutic use on the aforementioned diseases has been previously reported [2,11]. More specifically, recent studies have reported that WBV is a beneficial exercise modality for neurological, musculoskeletal and metabolic patients [2,12].

Taking all the above into consideration, research has been lately (the last 5-6 years) focusing on the efficacy of different WBV training programs so as to find the safest and effective exercise training regime. Thus, several studies have investigated either the acute (following one

Publication History:

Received: December 23, 2015

Accepted: December 30, 2015

Published: December 31, 2015

Keywords:

Vibration training, Mechanical stimulus, Physical fitness, Health, Rehabilitation

session of WBV exercise) or the chronic effects of WBV training in different systems of the human body such as cardiovascular, musculoskeletal, endocrine, nervous etc.

Acute effects of whole-body vibration exercise

The acute effects of WBV on different features of physical fitness and health are not clear. An acute bout of WBV using either side-to-side alternating or vertical simultaneous vibrations have shown to increase [13-15] or not change [16-18] vertical jumping ability, strength and/or balance. However, a 9.1% reduction in counter movement jump and/or strength has also been reported after exhaustive or prolonged WBV exercise [19]. The equivocal findings among studies may be due to the characteristics of WBV protocols, such as the training methods, the loading parameters, the body positions, and the mode of vibration. Although the results regarding power, strength and balance seem to be opposing, the vast majority of studies that investigated the acute effects of WBV exercise on flexibility documented significant improvement (by 8.2-16.2%) [16]. Additionally, an acute bout of WBV may: a) increase vasodilatation of vibrating muscles, cutaneous and deep vessel blood flow and muscle temperature, b) increase heart rate and c) reduce tissue viscosity and increase muscle elasticity [20]. Thus, WBV is recommended by many investigators as an alternative warm-up training routine. There is also evidence that a single bout of WBV may be a more efficient warm-up method compared to traditional methods, such as stretching, that may decrease strength and power. Finally, other studies that investigated the acute effects of WBV exercise on biochemical indices have also reported inconsistent findings. In detail, an acute WBV bout was found to reduce plasma interleukin-6 and muscle soreness after downhill running [21], as well as to increase plasma free fatty acids [22] and decrease plasma glucose concentration [23]. While previous study did not report any acute effect of WBV exercise on muscle and liver damage as well as on systemic inflammation [24].

Chronic effects of whole-body vibration training

Previous studies that examined the effects of a chronic WBVT program consisting solely of WBV on neuromuscular performance

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Citation: Gerodimos V (2015) Whole Body Vibration: A Revolutionary Mode of Exercise or A Trend? Int J Phys Ther Rehab 1: 109. doi: <http://dx.doi.org/10.15344/2455-7498/2015/109>

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have also reported inconsistent findings. Thus, chronic WBV studies have been shown to either increase or to have no-effect on neuromuscular performance. More specifically, WBV training studies using either vertical simultaneous or side-to-side vibration reported increase in flexibility, strength and power, as well as in walking ability, balance and mobility especially in untrained and elderly individuals [25-27]. On the other hand, reports have documented non-significant improvements in neuromuscular performance, using side-to-side or vertical simultaneous vibration, in young or physically active individuals or athletes [28-29]. For this reason, several studies have focused on the efficacy of combined vibration and neuromuscular/cardiovascular training programs to improve various indices of health and overall fitness in different populations. There is evidence that a combination of vibration and strength, flexibility and aerobic training is more effective than vibration training alone in counteracting the detrimental effects of a sedentary lifestyle on musculoskeletal and cardiovascular systems [3,30-31].

Whole body vibration and rehabilitation

Several studies in the literature have focused on the beneficial effects of WBV in patients who suffer from neurological, musculoskeletal and metabolic diseases [2,12]. In detail, there is evidence that chronic WBV exposure may decrease spasticity and pain levels in different clinical populations, while the results concerning strength, balance, mobility, gait and motor impairment are ambivalent [2,12]. More specifically, it appears that balance, mobility, strength, walking ability and motor impairment either increase or remain unchanged following WBV training interventions [2,12]. Therefore, WBV may be used, in some cases, as a better alternative to traditional modes of exercise for the improvement of functional capacity and quality of life, especially in clinical populations.

Taking all the above into consideration, whole-body vibration seems to be a less fatiguing and a less time-consuming mode of exercise for prevention of injury and for improving neuromuscular performance, particularly in less fit individuals. Whole-body vibration exercise takes place indoors and requires less volitional input that may increase adherence to exercise training program. Thus, untrained individuals or clinical populations, due to their inactive life-style and the relatively low level of physical fitness, appear as good candidates to benefit from a WBV training. However, it seems that WBV per se is not an adequate training stimulus for young or physically active individuals. Consequently, for young or active individuals is recommended WBV exercise in conjunction with traditional modes of exercise such as stretching, resistance and aerobic exercises.

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