

Whole Body Vibration Research Data

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The phenomenon of Whole Body Vibration has been causing major interest throughout the world as it physiologically surpasses many of the old tried and true techniques for building and maintaining athletic performance.

Machines utilizing the science of Whole Body Vibration are emerging world wide and the results have been significant for population groups such as the elderly through to the elite athletes.

The “physiological build” which occurs as a result of utilizing the science of Whole Body Vibration has been studied extensively and this paper is designed as a discussion paper / working document to outline some of the research which has been brought to the attention of clinicians and the community worldwide.

The science says that you can lose weight and build muscle and bone, faster and more easily than ever before using Whole Body Vibration (WBV).

The science is utilized by NASA, Olympic athletes and many pro sports teams, as well as normal working people and the elderly.

Whole Body Vibration works with the person standing on a vibrating platform which vibrates the body at 30-40 times per second and feels like deep massage.

The machine enables the person to get into different positions, in order to target different muscle groups; howbeit just standing on the platform is significant for a major workout.

Muscle fibers tense and relax at this speed of the platform, thus creating a workout without you actually doing any of the work or loading yourself.

There are many published studies on the science of WBV targeting specific muscles, bone density, strength, oxygen uptake, hormones, performance, balance, motor neurons, the elderly and wellness and health.

All of the articles attest to the benefits of this new and exciting science.

Data Summary

The following data has been compiled from research articles listed at the end of the paper in relation to biophysiological effects of Whole Body Vibration (WBV).

1. Proprioception

One of the main features of the WBV regime is that it significantly influences proprioceptive feedback mechanisms and other neural inputs leading to overall improvements in neuromuscular performance.

Quote

1. It is therefore likely that the effect of WBV treatment elicited a biological adaptation that is connected to a neural potentiation effect, similar to those reported to occur following resistance and explosive power training. In conclusion, it is suggested that WBV influences proprioceptive feedback mechanisms and specific neural components leading to an improvement of neuromuscular performance.

2. Effects of Aging

The science of WBV is used as a therapeutic intervention strategy to reduce the effects of aging on neuro-musculo-skeletal structures.

Quote

2. We are convinced that vibration could be an effective exercise intervention for reducing the effects of aging on musculoskeletal structures.

3. Improves Muscular Performance

WBV enhances muscle metabolism thus improving muscle activity.

Quote

3. These results further substantiate the view that WBV enhances muscular metabolic power and thus muscle activity.

4. Improves Muscular Performance and Body Balance

There are significant immediate results on muscular performance and balance following WBV

Quote

4. A single bout of WBV transiently improves muscle performance of lower extremities and body balance in young healthy adults.

5. WBV as cure for Low Back Pain

WBV is now seen by some researchers as a cure for low back pain.

Quote

5. Well controlled vibration may be the cure rather than the cause of low back pain

6. WBV facilitates neural potentiation

WBV is able to quickly facilitate an adaptation response associated with neural potentials.

Quote

6. It was suggested that the effect of WBV elicited a fast biological adaptation associated with neural potentiation

7. WBV does not close down circulation

WBV does not effect the body's circulation in the same way as occupational high frequency vibration

Quote

7. The results indicate that low frequency vibration does not have the negative effects on peripheral circulation known from occupational high frequency vibration.

8. WBV enhances neuromuscular excitability

WBV may significantly improve training regimes for the athlete and also for the neuromuscular rehabilitation programs.

Quote

8. It is followed that in exercise unto comparable degrees of exhaustion and muscular fatigue, superimposed 26 Hz vibration appears to elicit an alteration in neuromuscular recruitment patterns, which apparently enhance neuromuscular excitability. Possibly, this effect may be exploited for the design of future training regimes.

9. WBV poses no risk to the elderly

WBV is an effective tool for use with the elderly as it poses no medical or physiological risk.

Quote

9. The risk expected when vibrational exercise is applied to the elderly is negligible

10. WBV improves balance and muscle strength

WBV stimulates the reflexes of the body which in turn improves balance and motor strength

Quote

10. This type of training provides reflex muscle stimulation to improve balance and possibly the muscle strength, with no serious side effects.

11. WBV significantly enhances proprioception

WBV significantly and quickly improves the proprioceptive feedback of the lumbopelvic region

Quote

11. Overall, the findings of this pilot trial suggest that a five minute block of low frequency WBV induces a rapid improvement in proprioceptive ability in the lumbopelvic region.

12. WBV improves muscle activity

WBV enhances the ability of the body to use the muscular power more effectively and efficiently

Quote

12. WBV enhances muscular metabolic power and thus muscle activity.

13. WBV significantly improves muscular power in the elderly

WBV reflexively modulates the input into the neuromuscular system via the rapid muscle contractions.

Quote

13. This research was developed to evaluate the effects of different therapeutic approaches to locomotion and balance disorders. The reflexive reaction of whole body vibration relates to the neuromuscular system in a chain of rapid muscle contractions. The results were significant improvements in muscular power in the elderly.

14. WBV assists the elderly by decreasing the risk of falls

WBV has a significant effect in the rehabilitation and ongoing health of the elderly by minimizing the risk of falls.

Quote

14. Controlled whole body vibration can improve elements of fall risk in elderly patients.

15. Increased metabolic output observed with WBV is due to heightened muscular activity

The basal metabolic index which is associated with increased metabolic output is heightened by WBV

Quote

15. In several instances it was shown that metabolic power was better controlled by vibration than by a more complex voluntarily performed task, such as knee squatting

16. WBV significantly helps in low back pain

WBV in conjunction with weight bearing exercises significantly improves low back pain

Quote

16. WBV demonstrated a significant improvement in repositioning accuracy over time (mean 0.78 degrees) representing 39% improvement. It was concluded that WBV may induce improvements in lumbosacral repositioning accuracy when combined with a weightbearing exercise. This is a significant step forward in the rehabilitation of low back pain.

17. WBV enhances blood distribution throughout the body

WBV significantly enhances blood distribution throughout the body which assists in the healing process and in the distribution of nutrients and hormones.

Quote

17 Utilizing WBV therapy principles substantially improves muscle strength, performance and flexibility. Studies have shown vibration therapy enhances blood distribution, which is critical in regenerating damaged tissues as well as in the circulatory system's ability to deliver vital nutrients and hormones throughout the body. Ultimately, it can enhance an individual's general wellness and quality of life, regardless of age, physical and neurological condition.

Research References

1. Hormonal Response to Whole Body Vibration in Men

Eur J Appl Physiol (2000) 81: 449-454

The results suggest the Whole Body Vibration (WBV) treatment leads to acute responses of hormonal profile and neuromuscular performance. It is therefore likely that the effect of WBV treatment elicited a biological adaptation that is connected to a neural potentiation effect, similar to those reported to occur following resistance and explosive power training. In conclusion, it is suggested that WBV influences proprioceptive feedback mechanisms and specific neural components leading to an improvement of neuromuscular performance. Moreover since the hormonal responses characterized by an increase in Testosterone and Growth Hormone concentration, and a decrease in Cortisol concentration and the increase in neuromuscular effectiveness were stimulated but independent, it is speculated that the two phenomena might have common underlying mechanisms.

2. The effects of vibration on human performance and hormonal profile

Marco Cardinale
Semmelweis University Doctoral School
Faculty of Physical Education and Sport Sciences
Doctoral Program:
Empirical and theoretical issues in sport sciences
Program Director: Prof. Dr. Frenkl Ròbert
Supervisor: Prof. Dr. Carmelo Bosco
Budapest 2002

We are convinced that vibration could be an effective exercise intervention for reducing the effects of aging on musculoskeletal structures. The potential influence of vibration on hormonal activity also opens interesting perspectives for its application in training and rehabilitation programs for different pathologies. Due to the enormous potentials of vibration exercise treatments, it is also important to study the effects of long-term vibration exercise programs on different physiological parameters and define safe exercise protocols based upon individual responses to vibration stimuli. Ultimately, the effects of vibration exercise on musculoskeletal interactions need to be analyzed, to verify the effectiveness of this form of exercise on bone remodelling, including the potential effects on osteoporosis.

3. International Journal of Sports Medicine

Int J Sports Med 2002; 23: 428-432

Oxygen Uptake in Whole-Body Vibration Exercise: Influence of Vibration Frequency, Amplitude, and External Load

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The present findings indicate that metabolic power in whole-body VbX can be parametrically controlled by frequency and amplitude, and by application of additional loads. These results further substantiate the view that VbX enhances muscular metabolic power, and thus muscle activity.

4. Effect of a vibration exposure on muscular performance and body balance. Randomized

crossover study

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Clin Physiol & Func Im (2002) 22, pp145±152

This randomized cross-over study was designed to investigate the effects of a 4-min vibration bout on muscle performance and body balance in young, healthy subjects. Sixteen volunteers (eight men, eight women, age 24±33 years) underwent both the 4-min vibration- and sham-interventions in a randomized order on different days.

Six performance tests (stability platform, grip strength, isometric extension strength of lower extremities, tandem-walk, vertical jump and shuttle run) were performed 10 min before (baseline), and 2 and 60 min after the intervention. The effect of vibration on the surface electromyography (EMG) of soleus, gastrocnemius and vastus lateralis muscles was also investigated. The vibration-loading, based on a tilting platform, induced a transient (significant at the 2-min test) 2.5% net benefit in the jump height (P=0.019), 3.2% benefit in the isometric extension strength of lower extremities (P=0.020) and 15.7% improvement in the body balance (P=0.049). In the other 2-min or in the 60-min tests, there were no statistically significant differences between the vibration- and sham-interventions. Decreased mean power frequency in EMG of all muscles during the vibration indicated evolving muscle fatigue, while the root mean square voltage of EMG signal increased in calf muscles. We have shown in this study that a single bout of whole body vibration transiently improves muscle performance of lower extremities and body balance in young healthy adults.

8. Studies of oxygen uptake during non-exhaustive vibration exercise have shown that the energy turnover elicited by the vibration can be parametrically controlled by vibration amplitude, vibration frequency and by additional loads applied (Rittweger et al., 2002a). Together with the known influence of passive vibration on muscle spindle activity (Ribot-Ciscar et al., 1998), and with the neuromuscular findings presented here, we assume a substantial evidence for vibration exercise interacting with spinal reflex loops and possibly influencing these pathways. Thus, the view may be emerging that vibration exercise is a means to alter central motor control patterns. *Clinical Physiology and Functional Imaging* 23, 2, 81–86

10. *Keio J Med* 2004; 53 (2): 85–89

Whole-body vibration training with Galileo was developed as a new modality in physiotherapy. Galileo is a unique device for applying whole body vibration/oscillatory muscle stimulation. The subject stands with bent knees and hips on a rocking platform with a sagittal axle, which alternately thrusts the right and left leg 0.7–4.2 mm upwards and downwards at a frequency of 20 Hz, thereby stretching of the extensors or muscles of the lower extremities. The reaction of the neuromuscular system is a chain of rapid muscle contractions. This type of training provides reflex muscle stimulation to improve balance and possibly the muscle strength, with no serious side effects.

11. *Australian Journal of Physiotherapy* 2005 Vol. 51

Overall, the findings of this pilot trial suggest that a five minute block of low frequency WBV induces a rapid improvement in proprioceptive ability in the lumbopelvic region. Many aspects of the exercise prescription require further evaluation. In order to obtain an optimal outcome, future studies should consider the many posture and exercise variables, including duration of a single exercise bout and the frequency of the exercise application, as well as details of the vibration parameters. Incorporating vibration exercise into treatment needs to be developed with caution, as prolonged high frequency vibration is known to have detrimental effects on muscles, most particularly increasing fatigue (Bongiovanni et al 1990), and causing, in some circumstances, disturbances in proprioception (Brumagne et al 1999b, Ribot-Ciscar et al 1998, Rogers et al 1985).

12. The present findings indicate that metabolic power in whole-body VbX can be parametrically controlled by frequency and amplitude, and by application of additional loads. These results further substantiate the view that VbX enhances muscular metabolic power and thus muscle activity.

Int J Sports Med 2002; 23: 428-432

14. **Arch Phys Med Rehabil Vol 86, February 2005**

After 6 weeks, the vibration intervention group improved by a mean \pm standard deviation of 2.4 \pm 2.3 points on the gait score compared with no score change in the control group ($P < .001$). The intervention group improved by 3.5 \pm 2.1 points on the body balance score compared with a decrease of 0.3 \pm 1.2 points in the control group ($P < .001$). TUG test time decreased by 11.0 \pm 8.6 seconds in the treated group

compared with an increase of 2.6_8.8 seconds in the control group ($P_{.001}$). The intervention group had significantly greater improvements from baseline on 8 of 9 items on the SF-36 compared with the control group.

Conclusions: Controlled whole body vibration can improve elements of fall risk and HRQOL in elderly patients.

Key Words: Accidental falls; Elderly, Quality of life; Rehabilitation; Vibration.

16. *Australian Journal of Physiotherapy* 51: 259–263]

Patients with low back pain (LBP) often present with impaired proprioception of the lumbopelvic region. For this reason, proprioception training usually forms part of the rehabilitation protocols. New exercise equipment that produces whole body, low frequency vibration (WBV) has been developed to improve muscle function, and reportedly improves proprioception. The aim of this pilot study was to investigate whether weightbearing exercise given in conjunction with WBV would affect lumbosacral position sense in healthy individuals. For this purpose, twenty-five young individuals with no LBP were assigned randomly to an experimental or control group. The experimental group received WBV for five minutes while holding a static, semi-squat position. The control group adopted the same weightbearing position for equal time but received no vibration. A two-dimensional motion analysis system measured the repositioning accuracy of pelvic tilting in standing. The experimental (WBV) group demonstrated a significant improvement in repositioning accuracy over time (mean 0.78 degrees) representing 39% improvement. It was concluded that WBV may induce improvements in lumbosacral repositioning accuracy when combined with a weightbearing exercise. Future studies with WBV should focus on evaluating its effects with different types of exercise, the exercise time needed for optimal outcomes, and the effects on proprioception deficits in LBP patients.

[Fontana TL, Richardson A and Stanton WR (2005): The effect of weightbearing exercise with low frequency, whole body vibration on lumbosacral proprioception: A pilot study on normal subjects. *Australian Journal of Physiotherapy* 51: 259–263] Key words: Lumbosacral spine, Proprioception, Whole body vibration, 2-D motion analysis, Rehabilitation, Low back pain

17. American Fitness, March-April, 2003

Utilizing whole body vibration therapy principles, it substantially improves muscle strength, performance and flexibility. Studies have shown vibration therapy enhances blood distribution, which is critical in regenerating damaged tissues as well as in the circulatory system's ability to deliver vital nutrients and hormones throughout the body. Ultimately, it can enhance an individual's general wellness and quality of life, regardless of age, physical and neurological condition.

For more than two decades, Europeans have used vibration therapy for its profound enhancement of muscle strength, performance, conditioning, overall health and wellness, in addition to its integral role in rehabilitating injuries and improving the quality of life for those suffering [from] injury or debilitating conditions, such as multiple sclerosis or arthritis.