

# *Whole Body Vibration*

## *Therapy*

### Research Packet

Written by A. Joshua Woggon DC, Copyright 2011

#### Table of Contents

What is WBV Therapy? . . . . .	2
What makes the Vibe unique? . . . . .	4
Who should not use WBV Therapy? . . . . .	5
The Potential <i>Positive</i> Effects of WBV . . . . .	6
The Potential <i>Negative</i> Effects of WBV . . . . .	12
How Much WBV is Safe? . . . . .	17
Research & References . . . . .	20

## What is Whole Body Vibration (WBV) Therapy?

Whole Body Vibration therapy is a way of enhancing the benefit of your chiropractic care. It is a safe and effective way to improve balance & posture, prevent falls, and increase bone density without using drugs. It can also speed the healing of sprains, strains, fractures, and other injuries.

The Russian cosmonauts first investigated vibrating platforms as a way of maintaining bone & muscle mass while in outer space. Despite the fact that much of their initial research was never published, the positive benefits of this innovative new treatment soon attracted attention in Europe for its benefits in enhancing fitness & strength training. Soon vibrating platforms were appearing in health gyms & recreational centers. Scientists in the United States soon began evaluating vibration for its therapeutic benefits, and while initial research was promising, there was no cohesion amongst the results – some studies reported excellent improvements, some none, and some found negative effects. In reviewing these conflicting results, researchers soon noticed that in all of the experiment on vibration, there was a great deal of variability in the **frequency** and the **amplitude** (intensity) of the vibration between experiments.

A vibration is like a wave, repeated over and over again. Scientists quantify this wave through its **frequency** (the number of waves per second, measured in Hertz) and its **amplitude** (which is the size of the wave) – just like a radio receiver captures radio waves based upon their amplitude (AM) or frequency (FM). These two factors also determine the effect of vibration upon the body. Different tissues in the body will respond to different frequencies. For instance, research has shown that the collagen which makes up the cartilage of your joints and the discs between the bones of the spine responds to a slow pulse of 4 Hertz (four pulses per second). The muscles respond best to frequencies between 30 and 50 Hertz, and the ideal frequency window for stimulating bone growth is 30 Hertz.

These scientific studies that pinpointed the ideal “windows” of frequencies soon led to researchers to explore the positive benefits of WBV therapy on various systems of the body. Chiropractors first began using vibration therapy as a way of retraining the brain’s control over the muscles more effectively – this is known as **neuromuscular re-education**. When you stand on a vibrating platform, your postural muscles have to make multiple, rapid adjustments – as many as 50 times per second – to adapt to the stimuli and balance accordingly. For this reason, exercises & spinal rehabilitation performed upon the Vibe can be as much as 3 times more effective than if they were done alone. There are many other benefits of Whole Body Vibration therapy, as well.

In one study, sheep were placed on a vibrating platform for 20 minutes a day, five days a week. One year later, their bone density had increased by 34.2 percent. Another study conducted on postmenopausal women at high-risk for osteoporosis found significantly increased bone mineral density in the hip after 6 months, with just 3 treatments a week.

Vibration therapy has also been shown to:

- increase blood & lymph circulation
- reduce pain & inflammation
- promote the immune response
- increase healing of fractures, strains, & sprains
- help joint strength & flexibility
- decrease stress & increase energy levels
- aid in detoxification & removal of wastes from the body

## What Makes the Vibe Unique?

You may have noticed several other vibrating platforms on the market. In fact, it has become somewhat of a fad lately, with articles appearing in magazines such as *TIME* and *Health & Fitness* and in newspapers routinely. Many of these advertisements tout vibration therapy as an easy, quick way of losing weight, preventing osteoporosis, or staying fit. However, as we mentioned before, the effect that vibration therapy has upon the body is determined by its frequency and its amplitude.

Most other platforms have a dial that allows the user to adjust the frequency. This is often described as a positive “feature” of the unit. Unfortunately, many of these platforms have no method of determining the exact frequency it has been set at, and sometimes the frequency of the platform is measured to be different than what it is set to on the dial. Without knowing the exact frequency, there is no way of knowing which system of your body is being affected most. In addition, some frequencies have been shown to have negative effects upon the digestive, skeletal, and muscular systems of the body. If you try to “guess” which frequency is best, you are gambling with your health.

The amplitude of the platform is also very important. Some platforms use a strong frequency that can be damaging to your bones and joints. There are safe levels for vibration exposure, and the Vibe is designed in accordance with these guidelines. Some platforms are so powerful that standing on them for even one minute has the potential to induce long-term damage. You would need to stand on the Vibe for more than four hours in one day to exceed the safe limits.

The Vibe platform is constructed in the United States by skilled machinists and engineers. The motor used in the VIBE is a modified offset orbital cam design, producing **multi-dimensional vibration** that is transmitted through solid welds and bolts up to the vibrating plate. This is important because when the bones begin to deteriorate, the first bone cells to die are NOT the ones arranged in up-and-down fashion (the vertical trabeculae), but side-to-side (the horizontal trabeculae). Yet as these crossbeams are lost, the strength of the vertical pillars will obviously begin to suffer. It is important to be able to stimulate the crossbeams to re-grow so they will buttress the bone against compressive forces and resist fractures in ALL dimensions. This type of vibration is also the most beneficial in improving balance and preventing falls, because it stimulates a response in every direction.

## Who should not utilize WBV therapy?

**Prescription Drug Use:** Fosamax, Actonel, Aredia, Zometa, or any other osteoporosis prescription will reduce the effectiveness of the Vibe in improving bone density. This is due to the formaldehyde-like action of these drugs upon the bone tissue. By inhibiting osteoclastic activity, bone loss is stopped, *but so is bone growth*. If you want the full benefits of new bone formation from WBV Therapy, speak to your medical doctor about discontinuing use of these medications. Also, many prescription drugs are expressed as toxins in the body's tissues, which may cause nausea and dizziness. If you feel nauseous or dizzy while on the Vibe, please discontinue use and alert your doctor.

**Pregnancy:** There are no studies on WBV Therapy & pregnancy. Although it is unlikely that WBV Therapy within the established safety limits poses any danger to an unborn baby, it is always better to be safe than sorry, so please do not use the Vibe if you are pregnant or think you may be.

**Acute Thrombosis / Severe Cardiovascular Problems:** Theoretically, Whole Body Vibration can dislodge an embolism in an artery or vein, possibly causing a stroke or similar trauma. If you are at a high risk for cardiovascular accidents, you may wish to consult with your doctor before using the Vibe.

**Artificial Body Parts / Recent Surgeries:** Whole Body Vibration can be very challenging to the body, and those with large amounts of scar tissue may find the Vibe to be uncomfortable. Please do not attempt to push your body beyond its comfort zone in using the Vibe, especially after severe physical traumas such as surgery. We recommend waiting 6-8 weeks after any surgical procedure before using the Vibe.

**Epilepsy / Seizures:** It is not known if WBV may provoke seizures in epileptic individuals. For safety's sake, do not use the Vibe if you have a history of seizures.

**Acute Migraines:** The effect of the Vibe upon the muscles and circulation may trigger a migraine in those who have a history of acute migraines. Please consult your doctor before using the Vibe.

## **The Potential *Positive* Effects of Whole-Body Vibration on the Human Body:**

Various research articles have demonstrated that WBV therapy has the potential to achieve many benefits, such as:

- Bone remodeling
- Muscle strength
- Balance & posture
- Joint flexibility
- Hormone production
- Blood circulation
- Fat reduction

However, it is important to recognize that each of the studies that demonstrated these benefits was conducted under specific parameters of wave type, treatment protocol & duration, vibration intensity, & vibration frequency, and on a specific group of people. It is well-known that individual body types, tissues, & ages can respond differently to an identical vibrational waveform.

As an example, consider two studies<sup>1,2</sup> on very similar platforms (sinusoidal waves at a frequency of 30 Hz, one at 0.3 G, the other at 0.2 G). In the first study, WBV was applied for 10 minutes, twice daily, and the subjects showed no change in bone mineral density; the other group of participants showed improvements of 2.1% to 5% in bone & muscle mass, and only stood on the platform for half the time. What could be responsible for the different results? The first study tested older women (post-menopausal); the other looked at young females.

Scientists have pointed out that aging alters the responsiveness of bone tissue to mechanical forces such as vibration, and a stronger signal may be necessary to provoke a response. This hypothesis makes sense when one considers that another difference between the two studies mentioned above is the

amplitude (intensity) of the vibration that was used – the study on post-menopausal women used the lesser frequency of 0.2 G.

## **Bone Remodeling**

If you want to rebuild bone density on a vibrating platform, you need to understand which combination of waveform, frequency, & amplitude produces the same results as were achieved in the studies below:

- Decrease bone loss, increase bone density<sup>3</sup> (Flieger et al. 1998)
- Increase bone formation<sup>4</sup> (Rubin et al. 2001)
- Increase bone volume, increase bone formation rate<sup>5</sup> (Judex et al. 2002)
- Increase bone formation, decrease bone resorption<sup>6</sup> (Oxlund et al. 2003)
- Increase bone volume<sup>7</sup> (Christiansen & Silva 2006)
- Increase bone formation, decrease breakdown of bone tissue<sup>8</sup> (Xie et al. 2006)

Vibration at the wrong frequency, amplitude, or waveform has been shown to have no effect whatsoever on bone formation in the following studies:

- Vibration had no effect on bone formation<sup>9</sup> (Castillo et al. 2006)
- Vibration produced no change in bone mineral density<sup>10</sup> (Rubinacci et al. 2008)
- Bone mineral density in the hip did not change after WBV therapy<sup>1</sup> (Rubin et al. 2004)
- Both bone mineral density & bone remodeling factors were unaffected by WBV therapy<sup>11</sup> (Iwamoto et al. 2005)
- No change in bone mineral density was observed in the lumbar spine<sup>12</sup> (Gusi et al. 2006)

It is also important to realize that individuals who are currently taking, or have taken osteoporosis medication (such as Fosamax, Actonel, Boniva, etc.) in the last year, will not experience as dramatic improvements in their bone density with WBV therapy as individuals who are not currently taking these drugs. This is primarily due to the formaldehyde-like activity of these drugs upon the bones; while breakdown of old bone tissue is inhibited by these drugs, similarly, the creation of new bone tissue is also

impaired. Research articles conducted on subjects who were currently taking an osteoporosis medication did not demonstrate improvement.<sup>11</sup>

## **Muscle strength**

If you are interested in using a vibrating platform to build or maintain muscle mass, you'll need a product that can duplicate these results:

- Increased knee extensor strength, speed, & jump height<sup>13</sup> (Roelants et al. 2004)
- Slowed muscle atrophy & increased recovery time after bed rest<sup>14</sup> (Belayev et al. 2008)
- Improved muscle strength & motor capacity in nursing home residents<sup>15</sup> (Bruyere et al. 2005)
- One year of WBV therapy increased muscle strength & mass as much as undergoing a fitness program<sup>16</sup> (Bogaerts et al. 2007)
- Improvements occurred in the isometric & dynamic strength of post-menopausal women<sup>17</sup> (Verschuere et al. 2004)

Avoid frequencies and amplitudes that show no benefit whatsoever, or even decreased muscle performance, as evidenced by these studies:

- WBV produced no difference in hip or knee muscle strength<sup>18</sup> (Rees et al. 2008)
- Long durations of low-frequency vibration decreased neuromuscular performance time<sup>19</sup> (Floyd et al. 1973)

Just as the effect of WBV on bone formation can be helpful, harmful, or ineffective depending upon the type of vibration used, muscle tissue can similarly be affected in a positive or negative manner by different forms of WBV. As stated by Prisby et al.,<sup>20</sup> in perhaps the most comprehensive review of research on WBV therapy: *“Therefore, dependent upon the frequency and duration of the vibratory stimulus, WBV may be beneficial or detrimental to neuromuscular performance.”*

## **Balance & Posture**

WBV therapy has been suggested as the ideal non-drug treatment to reduce fractures, because not only have certain studies suggested improvements in bone density, there has also been published research showing enhancements in balance after WBV therapy. Obviously, having good balance helps to lessen the risk of fractures by reducing the chance of falling.

Individuals living with Parkinson's disease are particularly vulnerable to the risk of falls & fractures; they have approximately twice the risk of falling when compared to people of the same age who do not have Parkinson's. In some studies<sup>21,22</sup>, postural control & gait steadiness were improved when Parkinson's patients were exposed to WBV. In another study, however, WBV & standard balance training did not improve balance or gait stability in individuals with Parkinson's disease any more than balance training alone<sup>23</sup>.

## **Joint Flexibility**

People using WBV therapy have reported improved ranges of motion. Scientists are attempting to determine how WBV affects the joints & cartilage. There is a great deal of promise in this regard to determine if WBV could be an effective treatment suffering from osteoarthritis or degenerative joint disease. However, it is also known that excessive mechanical stress upon the joints can contribute to the development of osteoarthritis and increase the rate of degeneration in the joints. It is important to recognize that vibration has the potential to damage joints as well as to help repair them.

## **Hormone Production**

It is not currently known whether WBV therapy aids in building bone density due to pure mechanical stimulation, hormonal stimulation, or a combination of the two factors. Human Growth Hormone is essential to build strong bones & muscles. Testosterone also plays a vital role in this regard, for both males & females, and cortisol (the stress hormone) has been shown to break down bone & muscle mass. Therefore, it makes sense to assume that vibration which raises levels of HGH &

testosterone and decreases levels of cortisol would be more effective in building bone & muscle mass than WBV which did not produce this hormonal effect.

A great deal of attention has been devoted to an article, published in 2000 by Bosco et al, which demonstrated increases in testosterone & Growth Hormone levels, and a decrease in levels of cortisol<sup>24</sup>. However, research has since proven that not every type of vibration causes a hormonal response in the body. Consider the following information from scientific articles:

- No change in salivary testosterone or cortisol was noted<sup>25</sup> (Erskine et al. 2007)
- No effect on Growth Hormone & free or total testosterone<sup>26</sup> (Di Loreto et al. 2004)
- No change in testosterone; Growth Hormone & cortisol increased, then decreased during the first training session; no change in GH & cortisol levels noted during the last training session<sup>27</sup> (Kvorning et al. 2006)

## **Blood Circulation**

Researchers are devoting a great deal of effort to determine the effect of WBV therapy upon the circulation of blood & other fluids through the body. This information could be of great benefit to people suffering from diseases which affect the cardiovascular system, such as diabetes.

WBV therapy can also promote rehabilitation of the discs between the bones of the spine. Research has shown an increase in nutrient transport & waste removal in the intervertebral discs after exposure to WBV, which suggests that people suffering from disc degeneration or disc herniations could benefit from WBV therapy<sup>28</sup>. However, numerous studies have found an increase in disc & spinal problems amongst people who are exposed to certain frequencies of vibration for extended periods of time.

## Fat Reduction

As stated by Prisby et al,<sup>20</sup> “*One of the main advertising arguments for use of vibrating devices available on the market is that they promote weight loss or decrease fat mass; however, there is a lack of data in the literature to support these claims.*”

- In one study, 24 weeks of WBV did not alter body weight or total body fat in females<sup>29</sup> (Roelants et al. 2004)
- One of the foremost experts in the field of Whole-Body Vibration therapy, Clinton Rubin, was quoted as saying that once fat cells form, they tend to stick around, and vibrating won't get rid of them: “If you have a fat mouse, in order to get rid of the fat, you need to metabolize it, just as we've all learned.”<sup>30</sup>

The truth to WBV's application toward body composition & weight loss is that respiration, oxygen consumption & energy expenditure have all been shown to increase on a vibrating platform<sup>31,32</sup>, which does suggest that WBV can help to promote weight loss through increasing metabolism. Rubin's work, as reported in the *Proceedings of the National Academy of Sciences*, has shown that mice exposed to WBV for 15 minutes a day had 27-30% less fat 15 weeks later<sup>30</sup>. Bone marrow stem cells have the potential to turn into either bone or fat depending upon their environment, and Rubin theorizes that the increased mechanical stress upon the bones from WBV causes more of these precursor cells to develop into bone rather than fat.

In accordance with the research referenced above, there is not enough published data to support the claim that WBV Therapy will help you to lose weight, although research conducted on a vibrating platform that is very similar to the Vibe (in terms of frequency & amplitude) does demonstrate an increase in oxygen consumption & energy expenditure.

## **The Potential *Negative* Effects of Whole-Body Vibration on the Human Body:**

The effect of vibration on the body is dependent on several factors. As stated in the **WBV Good Practice Guide**, “...*The effects of vibration are therefore complex. Exposure to whole-body vibration causes motions and forces within the human body that may:*

- *cause discomfort,*
- *adversely affect performance.*
- *aggravate pre-existing back injuries, and*
- *present a health and safety risk.*

*“Low-frequency vibration of the body can cause motion sickness.*

*“Epidemiological studies of long-term exposure to whole-body vibration have shown evidence for an elevated risk to health, mainly in the lumbar spine but also in the neck and shoulder. Some studies have reported evidence of effects on the digestive system, the female reproductive organs and the peripheral veins.”*

While this revelation may surprise most people who have only heard about the numerous benefits of vibration therapy, healthcare professionals such as chiropractors & orthopedists have for years generally considered WBV to be harmful to the structure & integrity of the body. Exposure to WBV in the workplace has been commonly reported to be a leading cause of injury & long-term disability. There are established guidelines to regulate how much exposure to WBV therapy is safe.

Lately, however, the media has brought attention to the achievements of leading scientific researchers who, using specific parameters under controlled circumstances, were able to demonstrate amazing results in correcting bone & muscle loss, improving strength & flexibility, and reducing fat. Many companies began to capitalize upon this information by building WBV platforms that could be sold direct to the consumer for use at home. Unfortunately, many of these commercial platforms are claiming

to achieve the same benefits achieved in research trials, but they are not using the same parameters used in the research that demonstrated those benefits.

As an example, many platforms have controls which allow you to adjust the frequency and/or amplitude of the unit. The vast majority of scientific articles are published on a specific frequency and/or amplitude. Research has consistently shown that different tissues in the body respond differently to different frequencies. If you are trying to stimulate bone cell production, for example, there is one frequency to which those cells are “tuned-in.” As an example, FM radios are frequency-modulated; if you want to listen to your favorite station with the best possible sound quality, you need to tune in as closely as possible to that specific frequency. AM radios are amplitude-modulated, and also have specific numbers which give you the best possible signal. These two factors – frequency & amplitude – are very important in determining whether or not WBV therapy will be beneficial, ineffective, or harmful.

According to the ISO 2631-1 guidelines on *Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration*:

*“The relevant literature on the effects of long-term high-intensity whole-body vibration indicates an increased health risk to the lumbar spine and the connected nervous system of the segments affected. This may be due to the biodynamic behaviour of the spine: horizontal displacement and torsion of the segments of the vertebral column. Excessive mechanical stress and/or disturbances of nutrition of and diffusion to the disc tissue may contribute to degenerative processes in the lumbar segments (spondylosis deformans, osteochondrosis intervertebralis, arthrosis deformans). Whole-body vibration exposure may also worsen certain endogenous pathologic disturbances of the spine. Although a dose-effect relationship is generally assumed, there is at present no quantitative relationship available.*

*“With a lower probability, the digestive system, the genital/urinary system, and the female reproductive organs are also assumed to be affected.*

*“It generally takes several years for health changes caused by whole-body vibration to occur.”*

WBV therapy, like many other healthcare products, has the potential to cause harm if it is applied incorrectly.

Research has documented that certain frequencies have negative effects upon different parts of the body: working with frequencies around 8 Hz, researchers in Japan found that, “Short-term exposure to WBV led to a suppression of the activity of gastric smooth muscles and affect contraction wave,” essentially reducing the effectiveness of the digestive system<sup>33</sup>.

Other research articles have found that vibration *at certain frequencies, amplitudes, & waveforms* is completely ineffective at achieving the results produced by WBV using other parameters:

- One study reports, “...vibration did not induce a significant change in EMGrms, mean and peak angular velocities, moment and power, time to peak power, and initial power at 100 milliseconds after the start of the concentric phase for either resistance load. Therefore, in aiming to train neuromuscular output using maximal-effort dynamic contractions (40 and 70% 1RM), there is no benefit in employing direct vibration, at least with a 1.2-mm amplitude and 65-Hz frequency.”<sup>34</sup>
- From another studying testing whether WBV therapy might help to reduce ankle sprains, “After four weeks of WBV training no significant changes were found in latencies and reflex activity in both muscles in response to ankle sprain simulation. Similar results were observed for the time of ankle inversion motion. Based on the present results, it is unlikely that 4-weeks WBV training has beneficial effects on ankle joint stability in the case of an ankle inversion motion.”<sup>35</sup>
- Another study looking to see if WBV therapy could help athletes recover after a work-out concluded, “These results show no benefit of WBV on running performance recovery following a High Intensity Interval Training session.”<sup>36</sup>
- Researchers seeking to evaluate if WBV could enhance jump performance in young adult males found “No significant group differences were seen for 30-cm depth jump height between weeks 1 and 7,” and concluded that, “...amplitude, frequency, and duration of application of WBV seem to be important factors that need to be controlled for.”<sup>37</sup>
- One study wanted to find out if vibration could help prevent muscle being lost from disuse, to benefit astronauts. Volunteers spent two weeks in bed rest (with the headrest tilted down to counter the effect of gravity), and at the end of the two weeks, the researchers found “Vibration Therapy failed to counteract the decrease in leg muscle volume induced by Head Down Tilt bed rest.”<sup>38</sup>
- While WBV therapy has been shown to increase joint flexibility & improve balance, researchers tested ankle mobility using one specific platform and stated, “No significant changes in the measures of ankle dorsiflexion were found within or between treatments.”<sup>39</sup>

- Another research study attempted to use direct vibration at 65 Hz to enhance the strength of muscles in the leg, but found instead that “...*direct vibration, at the selected amplitude and frequency, does not enhance these neuromuscular variables in ballistic knee extensions during or immediately after training.*”<sup>40</sup>

It is important to us the consumer understand that WBV therapy, like all healthcare products, can be ineffective or even dangerous if it is not utilized properly. It’s also important to emphasize that WBV can be very beneficial and have absolutely no negative effects, provided it is done with a clear understanding of how the body will be affected by the specific waveform of the vibration.

Scientists working to unravel the mysteries behind WBV have begun testing a wide range of frequencies & amplitudes to determine how the body is affected differently by each. One study explored the effect of vertical sinusoidal vibration at a broad range of vibrational intensities, delivered in frequencies ranging from 10 to 90 Hz. They found that, “*Substantial amplification of peak acceleration could occur between 10 and 40 Hz for the ankle, 10 and 25 Hz for the knee, 10 and 20 Hz for the hip, and at 10 Hz for the spine.*”<sup>41</sup> Translating this into more easily-understood terms, what the authors are saying is that the intensity of this form of vibration can resonate more strongly (become amplified) in the ankle, knee, hip, & spine at certain frequencies, meaning that these tissues will be more affected (positively or negatively) by the vibration.

Furthermore, according to the same study: “*Beyond these frequencies, the transmitted vibration power declined to 1/10th-1/1000th of the power delivered by the platform.*” Obviously, if the vibration power is reduced to ten percent, or one-tenth of one percent, of the power that is produced by the machine, the effects will be similarly diminished.

They continue to state, “*Transmission of vibration to the body is a complicated phenomenon because of nonlinearities in the human musculoskeletal system.*” This is a very important statement. The Vibe was invented & perfected by a chiropractor with 35 years of experience in spinal biomechanics; this advanced understanding of how the body reacts in accordance to gravity & other laws of physics played a key role in the development of the Vibe.

The most comprehensive overview of the current research on WBV to date looks at dozens of different articles on the topic, and breaks them down into human & animal studies<sup>20</sup>. From there, the authors compare:

- 1) the specific *frequency* that was used in the study
- 2) the exact *amplitude* (intensity) at which the frequency was delivered
- 3) the *method of transmission* used to deliver the vibrational waveform into the body
- 4) the *physiological effects* that were documented in that study

It is very interesting to note that, in the majority of research conducted on WBV, the wave type is not even mentioned in the study. This makes it very difficult to determine exactly which type of vibration transmission method is superior.

The physiological effects of WBV vary widely depending upon the three variables outlined above. One highlight of the article is this statement by the authors: “*Currently, many companies advertise the use of WBV as an effective means by which muscle strength and bone mass (in addition to other physiological benefits) can be obtained. While some scientific evidence supports these claims (e.g., accretion of bone mass), the recommended advertisements should be viewed with caution since appropriate standards for use of vibrating platforms have not been established and validated for any segment of the population.*”

## How Much Whole-Body Vibration is Safe?

There are established standards to determine how much WBV is beyond a safe level, and mathematical formulas have been created to measure the total force that is put into the body by WBV. When this force exceeds a certain amount, long-term local or general tissue damage may result. This is an important factor to consider when incorporating WBV into your daily routine.

It is very important to ensure that the proper frequency, amplitude, & method of transmission are used with WBV. One study published in 2007 states<sup>42</sup>:

- *Excessive, chronic whole-body vibration (WBV) has a number of negative side effects on the human body, including disorders of the skeletal, digestive, reproductive, visual, and vestibular systems.*
- *Whole-body vibration training (WBVT) is intentional exposure to WBV to increase leg muscle strength, bone mineral density, health-related quality of life, and decrease back pain.*
- *The purpose of this study was to quantitatively evaluate vibration exposure and biodynamic responses during typical WBVT regimens.*

Volunteers stood on a WBV platform on one leg and on both legs; then, the researchers measured the dose of vibration and compared it to established safety standards. They found that:

- *The estimated Vibration Dose Value associated with typical RV [one-legged] and VV [standing] training regimens... exceeds the recommended daily vibration exposure as defined by ISO 2631-1.*
- *ISO standards indicate that 10 min of WBVT is potentially harmful to the human body... More research is needed to explore the long-term health hazards of WBVT.*

In a very well-written & enlightening article, Dr. Clinton Rubin elaborates on the potential of WBV therapy to cause great harm if applied incorrectly.<sup>43</sup> This article very clearly explains the reason why the frequency of the Vibe is fixed at 30 Hz and the amplitude at 0.3g. Different frequencies & amplitudes affect different tissues & have different results; the wrong frequencies & amplitudes will do more harm than good, and some companies do not appear to understand the research & science behind WBV therapy.

Here is an excerpt from the article:

*“A large body of research has demonstrated a broad range of **pathological responses** to high frequency (5 to 100 Hz), high magnitude vibration (greater than 1g) (6), including irrefutable evidence of such vibration magnitudes **contributing to low back pain** following extended exposure (7), and serving as a key etiologic factor in circulatory disorders such as Raynaud’s syndrome (3). Ignoring such dangers, g-forces that greatly exceed 1.0 are the very basis of devices referred to as PowerPlate, Galileo, SoloFlex, Galaxy, Nemes, and others, and **should be approached with extreme caution.**”*

*“The magnitudes used in those devices, well in excess of 8.0g, are **well beyond the limits** recommended for human tolerance by ISO and OSHA, are 35 times greater in amplitude than those mechanical signals that we study, are inherently dangerous, and to our knowledge, **show little if any evidence that their devices are safe** for bone, cartilage, muscle, tendon, ligaments or any of the major organs.”*

*“...it should also be pointed out that **no adverse effects** were observed in any of the preliminary trial with humans which kept vibration **below 0.3g** (13-15).”*

*“Please also note that our work has brought us to this point following several decades of searching for the mechanical signal to which bone is responsive. It is important to emphasize that although this low-level intervention is considered safe and beneficial, **other frequencies and amplitudes may cause damage** to bone and connective tissues, and **many amplitudes of vibration are considered pathogenic** to the musculoskeletal (e.g., vertebral disc, cartilage, ligament, tendon), neurovestibular, and cardiovascular systems. One should always be concerned that “too much of a good thing” may be true in mechanical stimulation, as well. Just because one aspirin is good for you, doesn’t mean that you should take 50 aspirin per day.”*

*“...please refer to the figure below to mark where 30Hz (cycles per second) is, and where 0.3g shows up, indicating **four hours of safe exposure each day**. There is also placed a mark where “PowerPlate” and*

*others are, in which the devices generate well over 10g... based on this graph, you should not subject yourself to **any more than one second** of such g-force on any given day! So, if your musculoskeletal system survives PowerPlate, **there is some likelihood that there will be some long term damage**. 0.3g, the work we do is 50x less, at least, than the powerplate-type devices.”*

As research continues to demonstrate, WBV used incorrectly is at best ineffective, and at worst, can have unintended consequences upon your health.

The Vibe was developed in accordance with the current standards for vibration safety from the European Union, the Canadian Centre for Occupational Health & Safety, and the International Standard Organization (ISO). An individual would need to stand on the Vibe for four hours in one day to exceed the safe limit for vibration exposure.

## Vibration Therapy Research & References

- 1) Rubin et al., 2004 C. Rubin, R. Recker, D. Cullen, J. Ryaby, J. McCabe and K. McLeod, Prevention of postmenopausal bone loss by a low-magnitude, high-frequency mechanical stimuli: a clinical trial assessing compliance, efficacy, and safety, *J. Bone Miner. Res.* **19** (3) (2004), pp. 343–351.
- 2) Gilsanz et al., 2006 V. Gilsanz, T.A.L. Wren, M. Sanchez, F. Dorey, S. Judex and C. Rubin, Low-level, high-frequency mechanical signals enhance musculoskeletal development of young women with low BMD, *J. Bone Miner. Res.* **21** (9) (2006), pp. 1464–1474.
- 3) Flieger et al., 1998 J. Flieger, T. Karachalios, L. Khaldi, P. Raptou and G. Lyritis, Mechanical stimulation in the form of vibration prevents postmenopausal bone loss in ovariectomized rats, *Calc. Tissue Int.* **63** (6) (1998), pp. 510–514.
- 4) Rubin et al., 2001a C. Rubin, A.S. Turner, S. Bain, C. Mallinckrodt and K. McLeod, Anabolism: low mechanical signals strengthen long bones, *Nature* **412** (6847) (2001), pp. 603–604.
- 5) Judex et al., 2002 S. Judex, L.R. Donahue and C. Rubin, Genetic predisposition to low bone mass is paralleled by an enhanced sensitivity to signals anabolic to the skeleton, *FASEB J.* **16** (10) (2002), pp. 1280–1282.
- 6) Oxlund et al., 2003 B. Oxlund, G. Ortoft, T.T. Andreassen and H. Oxlund, Low-intensity, high-frequency vibration appears to prevent the decrease in strength of the femur and tibia associated with ovariectomy of adult rats, *Bone* **32** (1) (2003), pp. 69–77.
- 7) Christiansen and Silva, 2006 B. Christiansen and M.J. Silva, The effect of varying magnitudes of whole-body vibration on several skeletal sites in mice, *Ann. Biomed. Eng.* **34** (7) (2006), pp. 1149–1156.
- 8) Xie et al., 2006 L. Xie, J.M. Jacobson, E.S. Choi, B. Busa, L.R. Donahue, L.M. Miller, C.T. Rubin and S. Judex, Low-level mechanical vibrations can influence bone resorption and bone formation in the growing skeleton, *Bone* **39** (5) (2006), pp. 1059–1066.
- 9) Castillo et al., 2006 A. Castillo, I. Alam, S.M. Tanaka, J. Levenda, J. Li, S.J. Warden and C.H. Turner, Low-amplitude, broad-frequency vibration effects on cortical bone formation in mice, *Bone* **39** (5) (2006), pp. 1087–1096.
- 10) Rubinacci et al., 2008 A. Rubinacci, M. Marenzana, F. Cavani, F. Colasante, I. Villa, J. Willnecker, G.L. Moro, L.P. Spreafico, M. Ferretti, F. Guidobono and G. Marotti, Ovariectomy sensitizes rat cortical bone to whole-body vibration, *Calcif. Tissue Int.* **82** (4) (2008), pp. 316–326.
- 11) Iwamoto et al., 2005 J. Iwamoto, T. Takeda, Y. Sato and M. Uzawa, Effect of whole-body vibration exercise on lumbar bone mineral density, bone turnover, and chronic back pain in post-menopausal osteoporotic women treated with alendronate, *Aging Clin. Exp. Res.* **17** (2) (2005), pp. 157–163.
- 12) Gusi et al., 2006 N. Gusi, A. Raimundo and A. Leal, Low-frequency vibratory exercise reduces the risk of bone fracture more than walking: a randomized controlled trial, *BMC Musculoskelet. Disord.* **7** (2006), p. 92.
- 13) Roelants et al., 2004b M. Roelants, C. Delecluse and S.M. Verschueren, Whole-body-vibration training increases knee-extension strength and speed of movement in older women, *J. Am. Geriatr. Soc.* **52** (6) (2004), pp. 901–908.
- 14) Belavy et al., 2008 D.L. Belavy, J.A. Hides, S.J. Wilson, W. Stanton, F.C. Dimeo, J. Rittweger, D. Felsenberg and C.A. Richardson, Resistive simulated weightbearing exercise with whole body vibration reduces lumbar spine deconditioning in bed-rest, *Spine* **33** (5) (2008), pp. E121–E131.
- 15) Bruyere et al., 2005 O. Bruyere, M.A. Wuidart, E. Di Palma, M. Gourlay, O. Ethgen, F. Richey and J.Y. Reginster, Controlled whole body vibration to decrease fall risk and improve health-related quality of life of nursing home residents, *Arch. Phys. Med. Rehabil.* **86** (2) (2005), pp. 303–307.
- 16) Bogaerts et al., 2007 A. Bogaerts, C. Delecluse, A.L. Claessens, W. Coudyzer, S. Boonen and S.M. Verschueren, Impact of whole-body vibration training versus fitness training on muscle strength and muscle mass in older men: a 1-year randomized controlled trial, *J. Gerontol. A: Biol. Sci. Med. Sci.* **62** (6) (2007), pp. 630–635.
- 17) Verschueren et al., 2004 S. Verschueren, M. Roelants, C. Delecluse, S. Swinnen, D. Vanderschueren and S. Boonen, Effect of 6-month whole body vibration training on hip density, muscle strength, and postural control in postmenopausal women: a randomized controlled pilot study, *J. Bone Miner. Res.* **19** (3) (2004), pp. 352–359.
- 18) Rees et al., 2008 S.S. Rees, A.J. Murphy and M.L. Watsford, Effects of whole-body vibration exercise on lower-extremity muscle strength and power in an older population: a randomized clinical trial, *Phys. Ther.* **88** (4) (2008), pp. 462–470.
- 19) Floyd et al., 1973 W. Floyd, A.B. Broderson and J.F. Goodno, Effect of whole-body vibration on peripheral nerve conduction time in the rhesus monkey, *Aerosp. Med.* **44** (3) (1973), pp. 281–285.
- 20) Prisby et al., 2008 R. Prisby, M.H. Lafage-Proust, L. Malaval, A. Belli, and L. Vico, Effects of whole-body vibration on the skeleton and other organ systems in man and animal models: What we know and what we need to know, *Ageing Research Reviews*, Volume 7, Issue 4, December 2008, Pages 319-329
- 21) Turbanski et al., 2005 S. Turbanski, C.T. Haas, D. Schmidtbleicher, A. Friedrich and P. Duisberg, Effects of random whole-body vibration on postural control in Parkinson's disease, *Res. Sports Med.* **13** (3) (2005), pp. 243–256.
- 22) Novak and Novak, 2006 P. Novak and V. Novak, Effect of step-synchronized vibration stimulation of soles on gait in Parkinson's disease: a pilot study, *J. Neuroeng. Rehabil.* **4** (3) (2006), p. 9.
- 23) Ebersbach et al., 2008 G. Ebersbach, E. Daniela, O. Kaufhold and J. Wissel, Whole body vibration versus conventional physiotherapy to improve balance and gait in Parkinson's disease, *Arch. Phys. Med. Rehabil.* **89** (2008), pp. 399–403.
- 24) Bosco et al., 2000 C. Bosco, M. Iacovelli, O. Tsarpela, M. Cardinale, M. Bonifazi, J. Tihanyi, M. Viru, A. De Lorenzo and A. Viru, Hormonal responses to whole-body vibration in men, *Eur. J. Appl. Physiol.* **81** (6) (2000), pp. 449–454.
- 25) Erskine et al., 2007 J. Erskine, I. Smillie, J. Leiper, D. Ball and M. Cardinale, Neuromuscular and hormonal responses to a single session of whole body vibration exercise in healthy young men, *Clin. Physiol. Funct. Imaging* **27** (4) (2007), pp. 242–248.
- 26) Di Loreto et al., 2004 C. Di Loreto, A. Ranchelli, P. Lucidi, G. Murdolo, N. Parlanti, A. De Cicco, O. Tsarpela, G. Annino, C. Bosco, F. Santeusano, G.B. Bolli and P. De Feo, Effects of whole-body vibration exercise on the endocrine system of healthy men, *J. Endocrinol. Invest.* **27** (4) (2004), pp. 323–327.
- 27) Kvorning et al., 2006 T. Kvorning, M. Bagger, P. Caserotti and K. Madsen, Effects of vibration and resistance training on neuromuscular and hormonal measures, *Eur. J. Appl. Physiol.* **96** (5) (2006), pp. 615–625.

- 28) Cheung et al., 2003 J. Cheung, M. Zhang and D.H. Chow, Biomechanical responses of the intervertebral joints to static and vibrational loading: a finite element study, *Clin. Biomech.* **18** (9) (2003), pp. 790–799.
- 29) Roelants et al., 2004a M. Roelants, C. Delecluse, M. Goris and S. Verschueren, Effects of 24 weeks of whole body vibration training on body composition and muscle strength in untrained females, *Int. J. Sports Med.* **25** (1) (2004), pp. 1–5.
- 30) **Vibrations Shown to Build Bone, Reduce Fat**, by Joe Palca, *Morning Edition*, October 29, 2007  
<http://www.npr.org/templates/story/story.php?storyId=15721992>
- 31) Da Silva et al., 2007 M. Da Silva, J.M. Fernandez, E. Castillo, V.M. Nuñez, D.M. Vaamonde, M.S. Poblador and J.L. Lanco, Influence of vibration training on energy expenditure in active men, *J. Strength Cond. Res.* **21** (2) (2007), pp. 470–475.
- 32) Garatachea et al., 2007 N. Garatachea, A. Jiménez, G. Bresciani, N.A. Mariño, J. González-Gallego and J.A. de Paz, The effects of movement velocity during squatting on energy expenditure and substrate utilization in whole-body vibration, *J. Strength Cond. Res.* **21** (2) (2007), pp. 594–598.
- 33) Miyazaki Y., Adverse effects of whole-body vibration on gastric motility, *Kurume Med J.* **47** (1) (2000), pp. 79–86.
- 34) Luo et al. 2009, Influence of resistance load on neuromuscular response to vibration training. Luo, J; Clarke, M; McNamara, B; Moran, *J Strength Cond Res* 2009 Feb 7; Vol. 23, Issue 2; Page(s) 420-6
- 35) Melnyk et al, Neuromuscular Ankle Joint Stabilisation after 4-weeks WBV Training. Melnyk, M; Schloz, C; Schmitt, S; Gollhofer, A. *Int J Sports Med* 2009 Mar 12
- 36) Edge et al., The effects of acute whole body vibration as a recovery modality following high-intensity interval training in well-trained, middle-aged runners. Edge, J; M; ündel, T; Weir, K; Cochrane, DJ. *Eur J Appl Physiol* 2008 Nov 18; Vol. 105, Issue 3; Page(s) 421-8
- 37) Lamont et al., Effects of 6 weeks of periodized squat training with or without whole-body vibration on short-term adaptations in jump performance within recreationally resistance trained men. Lamont, HS; Cramer, JT; Bemben, DA; Shehab, RL; Anderson, MA; Bemben, MG. *J Strength Cond Res* 2008 Nov 4; Vol. 22, Issue 6; Page(s) 1882-93
- 38) Zange et al., 20-Hz whole body vibration training fails to counteract the decrease in leg muscle volume caused by 14 days of 6 degrees head down tilt bed rest. Zange, J; Mester, J; Heer, M; Kluge, G; Liphardt, AM. *Eur J Appl Physiol* 2008 Oct 31; Vol. 105, Issue 2; Page(s) 271-7
- 39) Kemertzis et al., Ankle Flexors Produce Peak Torque at Longer Muscle Lengths after Whole-Body Vibration. Kemertzis, MA; Lythgo, ND; Morgan, DL; Galea, MP. *Med Sci Sports Exerc* 2008 Oct 11
- 40) Luo et al., Effect of vibration training on neuromuscular output with ballistic knee extensions. Luo, J; McNamara, B; Moran, K. *J Sports Sci* 2008 Oct 1; Vol. 26, Issue 12; Page(s) 1365-73
- 41) Kiiski et al., Transmission of vertical whole body vibration to the human body. Kiiski, J; Heinonen, A; J; ärvinen, TL; Kannus, P; Siev; änen, H. *J Bone Miner Res* 2008 Mar 20; Vol. 23, Issue 8; Page(s) 1318-25
- 42) Abercromby et al., Vibration exposure and biodynamic responses during whole-body vibration training. Abercromby, AF; Amonette, WE; Layne, CS; McFarlin, BK; Hinman, MR; Paloski, WH. *Med Sci Sports Exerc* 2007 Oct 3; Vol. 39, Issue 10; Page(s) 1794-800
- 43) Contraindications and Potential Dangers of the Use of Vibration as a Treatment for Osteoporosis and other Musculoskeletal Diseases: the Safety of Vibration as an Intervention for Osteoporosis, by Clinton Rubin.