



WHOLE BODY VIBRATION

Good vibrations

By Pedro van Gaalen, Managing Editor

Is vibrating your way to a toned physique, improved strength and overall fitness the next big thing – or is it all another health industry shake down? **fitness** investigates....

There is no shortage of “magic supplements”, fad diets and wonder exercise equipment being peddled, through the mass media, by unscrupulous marketers who aim to capitalise on unsuspecting and ill-informed consumers looking to lose weight or get into shape without committing to a complete change in lifestyle, getting a new gym membership and following a healthy eating plan.

So its no wonder that a new wave of exercise equipment, touting amazing results from a passive exercise technique called vibration training is raising a few eyebrows.

The rise in popularity of Whole Body Vibration (WBV) training has caused its fair share of controversy. Despite this the industry has seen a large number of manufacturers enter the market with various machines, all better than the next, promising “increased frequency to activate 100% of muscle fibres” or “lose weight and tone muscle in just 12 minutes”. There is, of course, a great deal of research material available on the effectiveness of this ‘new’ form of training, ensuring that there are two distinct camps with regard to this technology – the naysayers and the believers.

I use the term “new” loosely in the context of WBV training, as it has been around in some form for close on four decades.

The Russian space programme incorporated this type of exercise

to prepare cosmonauts for the rigours of life in space, used mainly to combat the loss in bone density experienced during extended stays in zero gravity environments. Using this WBV technology, the Russians were apparently able to set a record for the longest time spent in space, at more than 420 days. The American astronauts, who used conventional exercise equipment to train could only manage 120 days before they were forced to cease their mission due to bone and muscle degeneration.

The first country to commercially manufacture a WBV training machine was Holland. Since then, the technology has slowly gained mainstream acceptance over the last 15 years, to the point where there is now widespread debate in the health and fitness world on the effectiveness and validity of the research conducted on this form of training. What can't be ignored though is the sheer volume of research material available. The positive findings of a large proportion of this research, coupled with a growing number of positive user experiences and results has meant that a number of people, institutions and organisations are now using or offering this form of exercise equipment, including sports science institutes, large gym chains and professional sports teams.

FACT

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How it works

The basic premise of vibrational training is that the vibrations created through the machine activates an increased number of muscle fibres when executing a weight bearing exercise on the machine. The high-frequency vibration is also said to improve flexibility by releasing connective tissue, increase circulation due to the muscle pumping action, improve bone density and provide a hormonal 'kick'. Once the vibration stimulus reaches a certain threshold the action induces a reflex that causes involuntary muscle contractions, which target both primary and involuntary muscles. The involuntary contractions induced when training on a vibrating platform fire the muscle much more efficiently than voluntary muscle contractions that occur during conventional weight training. The muscle contractions derived from WBV training are also said to occur at a very rapid rate. As these muscle fibres are activated to a greater degree during WBV training, anyone using this mode of exercise will benefit from an improved response to muscle adaptation.

According to Murray Seaton, General Manager for HyperVibe, an Australian team that researches, develops and trains with WBV machines, WBV works by activating the muscles via a reflex known as a stretch reflex, which occurs when a muscle is lengthened and a receptor is stretched. "Within each muscle there is a special muscle fibre known as the annulo-spiral receptor," he explains. "This receptor is sensitive to the rate and extent that the muscle is being stretched. As the muscle lengthens this receptor sends a signal, proportional to the amount and rate of stretch, to tell the muscle to contract. This is a safety mechanism to prevent the muscle being overstretched, and is in-fact the same mechanism that causes the knee jerk reaction when the doctor tests the patellar reflex. On a WBV machine, the mechanical stimulus of the vibrating platform will rapidly stretch a muscle, causing a stretch reflex contraction to occur. There is a catch though, as the stimulus needs to be fast enough to derive that response, just like the doctor needs to strike the patellar tendon at a sufficient rate to cause the knee jerk reac-

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tion. Many people are therefore being sold vibration massage machines passed off as vibration training machines, which doesn't help consumer scepticism."

This speed is measured by the frequency of WBV machines, which can range from three to 50 Hertz (Hz) depending on the model and manufacturer, with lower frequency oscillations ideal for balance and massage, while higher frequencies in excess of 26Hz are best for training and muscle toning. "Current research suggests that frequencies below 12Hz do not activate the stretch reflex, because the stimulus isn't fast enough," continues Seaton. "Furthermore, a number of papers have shown that the optimum frequency for muscle activation occurs somewhere around 30Hz for most users, and that frequencies a bit higher can be beneficial for improving bone density. The theory is, because the stretch reflex in the average fast twitch muscle fibre takes approximately 35-50msec to complete, the muscle is capable of only absorbing about 20-30 vibrations per second (20-30Hz), and that frequencies above 30Hz will still cause maximum muscle activation. However, little is known about how the body absorbs vibrations above 30Hz.

"Other studies show that a frequency of 35Hz is ideal to improve bone density, as the excess vibration is absorbed by the bones," says Seaton. "However, it is generally believed that enough benefit

can be derived from frequencies below 30Hz to improve bone density, as there is speculation that excessive vibrations could cause micro-trauma to the joints. Frequencies of between 8 and 12 to 15Hz are used for relaxation of the muscle. This frequency range is too fast to be useful for balance, but too slow to activate the muscles. In a clinical setting, practitioners will use these frequencies to break high muscle tone, whereas someone with low muscle tone would use higher frequencies. Therefore, the key to vibration training is to cross the frequency threshold where the stretch reflex is activated, while under sufficient load. This load is created by the G force generated through the movement of the platform. The best results are generally achieved by using a machine above 20Hz, with a G force above 10Gs."

Through its vibrating platform WBV machines allow users to sit, stand or perform exercises for warm-ups, neuromuscular core work, strength training or an active cool-down. The method through which these platforms vibrate vary greatly, from air suspension, sonic vibration or magnets,

to moving plates or a central pivot that acts like a wobble board. However, regardless of mechanism, WBV equipment is classified into two distinct categories, namely pivotal or linear. There is once again a split in the industry as to which type is best. Pivotal machines, also referred to as alternate, oscillating, triangular oscillating or rotational machines, are best for improving balance as they are the only machines that can operate

lower frequency oscillations ideal for balance and massage, while higher frequencies in excess of **26Hz** are best for training and muscle toning.

Vibration training jargon:

Hertz (symbol: Hz): A unit of frequency that is defined as the number of complete cycles per second, used to measure any periodic event, the most common being radio and audio frequencies. It is the International System of Units (SI) for frequency and is used worldwide in both general-purpose and scientific contexts.

Frequency: Frequency is the number of occurrences of a repeating event per unit time. The period is the duration of one cycle in a repeating event, so the period is the reciprocal of the frequency. The ideal frequency for WBV training equipment is between 5 and 30Hz.

G Force: The G Force experienced by an object is its acceleration relative to free-fall. It is termed "force" because proper accelerations cannot be produced by gravity, but instead must result from other types of forces. This usually places stress and strain on the objects, making these sorts of forces more notable.

below 20Hz, and the rocking action of the pivotal machine forces you to use your stabilising muscles to maintain balance and counter the rocking motion. These machines also offer more functionality with regard to treatment, while research also indicates that pivotal machines produce greater muscle activation. Lineal machines, also referred to as vertical, uniform or piston machines, offer more functionality in terms of the exercises you can do on them, but research has shown that the use of lineal machines can transfer excessive vibrational forces to the head.

WBV training also activates the nervous system, making it a great way to warm up before an exercise programme. Supporting this are studies that shown that the immediate effects of short-bout vibration were beneficial for physical performance (Torvinen et al,2002). This means that if you do an exercise after a WBV warm up you should be able to exert more power throughout the subsequent movement.

Adding to a growing list of benefits, additional research findings have indicated that WBV training can increase hormonal levels of testosterone and growth hormone, while reducing cortisol levels in recreationally active people (Cardinale and Wakeling, 2005), reduce cellulite in women (Frank and Moos, 2004), provide an alternative exercise strategy for the elderly and post-menopausal women, who require an exercise modality to increase bone density that is less risky than traditional resistance

training (Verschuieren et al, 2003), and it can also act as a countermeasure for the loss of bone minerals (Rittweger et al,1999).

Despite the need for more research, Seaton explains that anyone reviewing existing studies that show negative effects from exposure to vibration should be cautious in interpreting the studies. "Most of the studies were based on research of a modality other than vibration platforms, and instead actually show the detrimental effects of prolonged exposure to industrial or workplace vibration, like standing on a jackhammer or driving

a vibrating truck," he says. One concern raised by certain experts is the affect that WBV training has on the body's vital organs. The resonance frequency of our vital organs is between five and 20Hz, so certain studies have advised against subjecting the body to these frequencies.

"In over 15 years of commercial use and dozens of published papers, there is no evidence of vital organ damage ever occurring through the use of WBV as a treatment modality," says Seaton. "A review paper on 'Resonance Catastrophe' by J. Rittweger suggested that, while it is unknown whether resonance in WBV exercise is large

enough to cause any actual harm, it would be prudent not to use frequencies around and below 5Hz, and to exercise specific caution with frequencies below 20Hz. However, it is widely accepted now that ascribing the Resonance Catastrophe theory to WBV training is a little over cautious."

As a result of this research an international standard, ISO 2631, was created for safe exposure levels to WBV. "Despite WBV therapy/training platforms being commercially available, safely used, and studied for over 15 years, there are still some researchers and suppliers who warn of using high G vibration machines, which exceed the ISO 2631 recommendations," says Seaton. "On the other hand, proponents of high G machines state that ISO standards are based on long term exposure to random, uncontrolled vibration, often directed straight to the spine, like in the case of truck drivers, as opposed to short therapeutic bursts of controlled vibration directed at the hands or feet as a treatment modality." This was addressed directly in the science journal *Medicine Science in Sports Exercise*. 39(9):1642-1650, September 2007 "WBV training health risk cannot be accurately calculated using ISO health standards, because of the intermittent nature of WBV training as a treatment modality. More research is needed to develop a new method of assessing negative side effects when the WBV is intermittent."

Our conclusion...

While there are still a few questions that remain to be answered, like figuring out where else WBV can add value in an integrated exercise programme, identifying what the safest dosage of vibration is over a given time period, as well as what dosages will work best for different populations, such as the elderly and post-menopausal females, the general consensus in the market is that this technology definitely works to improve strength

ADVANTAGES OF WBV TRAINING:
IMPROVE MUSCLE TONE
IMPROVE FLEXIBILITY
IMPROVE MUSCLE STRENGTH
REDUCE CELLULITE
INCREASE CIRCULATION
INCREASE BONE DENSITY

and flexibility, as well as tone muscle. The potential to enhance the training regimes of athletes is also quite promising. But just like everything else in the health and fitness industry, these results are only achievable if the basic principles of exercise are followed. For example, improved muscle tone can only be achieved using WBV training if a calorie restricted, high protein diet is followed, or

exceptional gains in muscle strength and power, especially sports specific advancements, can only be achieved when WBV training is augmented into sports specific resistance and cardiovascular training programmes.

At the end of the day WBV training needs to be viewed as an additional means to supplement current training methods to improve and possibly accelerate physiological adaptations to weight training. "The most important point getting lost in all the hype is that WBV training is not the be all and end all of training equipment," explains Seaton. "This is, in fact far from what we would like the market

to know about this mode of exercise. Firstly, WBV cannot deliver results that traditional cardiovascular training can, so anyone telling you that it is a great way to burn hundreds of calories in ten minutes and dramatically improve cardiovascular fitness is not being honest. It is also never going to replace specialised weight training programmes followed by bodybuilders, power lifters and various athletes. However, research clearly shows that this form of exercise can offer better results than standard resistance training, such as free weight, machine based and body weight exercises," concludes Seaton. **f**

Check out the next issue of *fitness* magazine for a guide to WBV training exercises that you can try at your local gym, should they have a WBV training machine.

Improve
your
Fitness
Health &
Wellbeing



*More Efficient
Than Conventional
Resistance Training*

The Most Affordable
True Vibration
Training Machine,
In the World!

Frequency	Optimum Range For
6-8 Hz	<ul style="list-style-type: none"> • Balance and Stability
9-14 Hz	<ul style="list-style-type: none"> • Relaxation of muscles • Injury rehabilitation • Blood circulation • Lymphatic drainage • Mobilization of joints • Healing scar tissue
15-22 Hz	<ul style="list-style-type: none"> • Muscle strength • Improved Co-ordination • Blood circulation • Lymphatic drainage • Stress Incontinence
23-28 Hz	<ul style="list-style-type: none"> • Muscle strength • Hormonal changes • Neurological stimulation • Improved muscle tone • Increased bone density • Blood circulation • Lymphatic drainage • Decreased lower back pain

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