

**An Introduction to the
Benefits of Power-Plate
for a Healthier Population**



A decorative graphic on the left side of the page, consisting of several concentric, curved lines in shades of gray, resembling a stylized wave or a series of overlapping arcs.

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Introduction

It has recently been estimated that almost two-thirds of new members joining health and fitness facilities were previously members of another club. This figure suggests that if the trend continues, the health and fitness industry will soon run out of genuine new members.

If you add to this the fact that 16% of the UK population is over sixty-five years of age and that this percentage is increasing, you may wonder what can be done to slow down the decline in membership levels.

When questioned, people stated the following as reasons for either not joining a club or not taking part in regular, structured physical activity:

- Too physically demanding
- Too complicated
- Not enough time
- Feeling uncomfortable in a social setting
- Bad previous experiences
- Not achieving goals or expectations not being reached
- Feelings of lack of support.

From a psychological point of view, these beliefs can be complicated and deep-rooted and should be simply accepted rather than questioned. The challenge is then to find a way to help them to change their beliefs about physical activity.

For the first time, the Power-Plate offers a form of exercise that can help to achieve this goal. In doing so, it can also help this group of people to achieve the effects and changes that they actually desire deep down.

This presentation is designed to provide an overview of the Power-Plate and how it works. It also provides case study material and research information into the effects of Whole Body Vibration training on various health conditions.

So What is the Power-Plate?

The Power-Plate is one of the most exciting technological advances in the fields of sports medicine, athletics, health and fitness.

Using the principles of Whole Body Vibration (WBV) training, the Power-Plate can help people to improve sports performance, enhance fitness and wellness and even accelerate recovery from injury.

The Health and Fitness and Sports Performance industries are rife with fads and trends. Often, these products or activities rely on unfounded claims with little research or evidence to support them and results do not justify the hype.

This is not the case with WBV training, which has more than 30 years of practical and scientific research to support its efficacy. It has become increasingly clear that this training technique is valid, effective and will continue to grow.

Whole Body Vibration training provides the following advantages:

- Shorter training time for similar results
- Increased muscle strength
- Improved flexibility
- Intense stimulation and increase of neurological system
- Increased blood circulation
- Aids in the reduction of pain
- Increased bone mineral density
- Increased levels of key hormones - Testosterone, Human Growth Hormone, IGF-I and Serotonin
- Massage applications
- Decrease in Cortisol levels (stress hormones)
- Increase in balance and coordination.

As research continues, we are learning even more about the benefits of WBV training.

Although studies use different variables in vibration and methodology, they all point to the benefits of using WBV. As our understanding of this type of training increases, the implications in terms of who could derive benefit from it also become clearer. As a result of this, new research is being conducted into the use of the Power-Plate in a health and fitness environment.

The History of Whole Body Vibration

Whilst Whole Body Vibration (WBV) may seem like a brand new technological innovation, the use of vibration for therapeutic purposes actually dates back to the ancient Greeks who utilised it to help heal injuries. The device they used consisted of a sheet of fabric with one end wrapped around the injured body part and the other end tied to a flexible saw that provided the vibrations. Late in the 19th Century, famed physician John Harvey Kellogg used mechanical vibrations to treat patients at Battle Creek Sanatorium.

WBV is based on Rhythmic Neuromuscular Stimulation (RNS) which dates back to 1960 when Professor W. Biermann, from the former East German Republic, described 'cyclical vibrations' capable of improving the condition of the joints relatively quickly.

Russian scientist, Vladimir Nazarov, became the first person to utilise vibration training in its most modern application - Biomechanical Stimulation (BMS). With this technology he was able to investigate involuntary muscle contractions and involuntary movement. This information, coupled with the mounting knowledge of voluntary movement, allowed them to answer many questions regarding neuromuscular control.

The Russian Space Program utilized WBV to allow its cosmonauts to stay in space longer without experiencing adverse reactions. Later, ballet dancers with minor muscle injuries such as Achilles Tendonitis discovered that vibration aided the healing process. They also found that their muscular strength and jump height increased with only a quarter of the effort or time required by traditional training methods. This led many of Russia's top Olympic athletes to incorporate WBV into their training programmes. Since then, many other athletes have discovered the benefits of vibration training.

In 1999, Guus van der Meer, a Dutch Olympic team trainer, began to test the reaction of healthy, untrained volunteers to WBV training. Based on positive results, he developed the Power-Plate and set up special training programs to meet the demands of the health and fitness sector.

The Power-Plate is now used by a wide range of people from athletes looking to improve their performance, to individuals attempting to improve their fitness and wellbeing and those who have a disability or illness that can be relieved or alleviated by WBV training.

A selection of research studies providing an insight into the successful use of the Power-Plate is included in the Appendix. Below are some examples of how individuals have benefited through their use of the Power-Plate.

Case Histories

Dorothy McCuller - Sciatica

Dorothy McCuller developed severe Sciatica in 2001 from lifting piles of leaflets at work. She was barely able to walk and was in constant pain.

She was treated by a Chiropractor, tried Bowen Therapy and after years of unsuccessful alternative treatment, she underwent hospital physiotherapy, which relieved the pain temporarily. However, her lack of exercise contributed to her gaining a substantial amount of weight and this further impeded her progress.

In February 2005, she saw an advert for the Power-Plate in the Evening Standard and attended a Power-Plate session at the Studios in Crawford Street W1.

To begin with she was so stiff she could hardly move and training was painful. After just five months, she was able to do all the exercises - albeit at advanced beginner level - and she could even run a bit.

Dorothy cannot praise the Power-Plate enough. She has seen a vast improvement in her condition and fitness levels and has lost more than a stone in weight. She now trains twice a week for 30 minutes.

"The benefits have kept a constant smile on my face and have given me hope for a slimmer and stronger body, which I have not had since 2002".

Kay Smith - Osteoporosis

Kay Smith discovered the benefits of the Power-Plate after a bone density test at the age of 50 which showed that she had lost 20% of her bone density in just two years.

She was prescribed the highest dose of Fosamax but wasn't happy about having to take drugs to combat the disease and researched a natural means of building bone.

She began using the Power-Plate three times a week in December of 2004. Eight months later her bone density had increased in the spine by 3.5%, in the neck of the right hip by 2.5% and in the neck of the left hip by 0.4% (the smaller increase was attributed to Scoliosis and the fact that she puts more weight on her right side).

"I was hoping to stop any more bone loss; but I actually built bone whilst going through the Menopause, a time when bone loss is particularly rapid for women. I also completely avoided the use of drugs and hormones. I am so grateful to Power-Plate for such a wonderful machine. It really has changed my life!"

Marian Harris - Broken Back

Marian is 55 years old and almost lost her life in a horrific coach crash in Menorca five years ago when she suffered from a broken back and fractured skull and ribs. She spent three weeks in intensive care on a life support machine after a back operation before being air-lifted back to England.

She spent six months in bed and then another month in a wheelchair and experienced almost continual pain. Her joints and muscles were so stiff and her back so painful that it would take her two hours to get dressed.

Her first experience of the Power-Plate 18 months ago changed her life. She sat on it for one minute with it in 'back relaxer' mode and when she stood up, she was pain-free for the first time since the accident. She bought her own Power-Plate in May 2004 and set up a studio targeting those with Osteoporosis and Arthritis. She can now dance again and although she still has to walk with a stick, she rarely has to use a wheelchair.

"I lost all muscle density and became very stiff after the accident. The Power-Plate is helping me to build my strength up and with it I get immediate pain relief. The first time I experienced it, I knew I had to have one."

Case Histories

Mike - Skeletal Problems, Legs

Marian Harris's brother Mike has experienced a number of physical problems due to having his leg lengthened when he was 11 years old.

He suffers from continual pain, but is able to alleviate the discomfort when he uses Marian's Power-Plate. Using the machine not only relieves the pain, it also gives him better mobility in his ankle.

"Mike doesn't use the Power-Plate as regularly as he should because he is very busy. He always turns up on my doorstep when it is giving him problems or when he knows he will need to do a lot of walking during the day - five minutes just for his legs, makes him pain-free."

Russ - Spondilitis

Russ, a Spondilitis sufferer for 12 years (stiffening of the spine), was previously a non-exerciser.

In September 2005, he joined Fitness First and was advised by the personal trainer to use the Power-Plate. With her help on the machine, he has succeeded in relaxing his body properly for the first time in 12 years.

"The Power-Plate has become my new best friend. Its vibrations relax all those tense muscles giving me such a feeling of well being. It makes me smile and makes my muscles do what they are supposed to do. What a wonderful piece of technology, it has completely changed my life!"

The Power-Plate in Practice

The Power-Plate in Practice

The way the body reacts to Whole Body Vibration training has a significant effect on the results it produces. The most important and probable explanations are discussed below.

Increased Strength

In everyday life, gravity has the greatest effect on muscular development. Specific training programmes that are designed to improve muscle strength utilise fast and abrupt changes in gravity, which increase its influence on muscle structure. Weights and other forms of resistance are used to achieve this.

Muscle strength increases through resistance training when proper progression and protocol are employed. This is called super compensation

Application of vibration training follows the same principles as conventional power training - the increased influence of gravity is caused by increased gravity acceleration. In other words, WBV creates a change in gravity without excessive loads being placed on the musculo-skeletal structure.

The physiological evidence of this improved muscle strength can be seen through Neurological and Myogenic Adaptation.

Neurological Adaptation

Neurological Adaptation occurs as a result of exercise and is therefore often referred to as 'the fast adaptation'. The process can be summarised as a faster accessibility of the motor units and more effective execution of the muscle contraction. This is achieved through:

1. Improved synchronization of the impulses
2. Improved co-contraction of the synergists
3. Inhibition of the antagonists
4. Recruiting number of motor units
5. Recruiting types of motor units.

The body learns to use the neurological possibilities available in an optimal way. This is called Motor Learning.

Myogenic Adaptation

Myogenic Adaptation is the body's ability to adapt to a stimulus over an extended period of time. There are four main factors that are involved in this specialised type of adaptation:

1. Hypertrophy - an increase in size brought about by the body's ability to create more proteins, thus making the muscles bigger and stronger.
2. Intra-muscular coordination - this is when the muscle fibres within the same muscle start working together in a smoother and faster way, resulting in a stronger, more toned muscle.
3. Hyperplasia - an increase in muscle cell numbers, resulting in an increase in muscle size and strength.
4. Influences on fibre typification - This allows the body to maintain its fast twitch muscle fibres for longer, thus improving and developing its capacity to develop power and agility.

At first, increases in strength stem from a Neurological Adaptation and are characterised by an improved neurological system. These neurological adjustments can set in after only a few days when using WBV, rather than up to 10 weeks, as is the case with conventional exercise. Myogenic Adaptation, which usually takes a few months, can take just a few weeks. The way in which Whole Body Vibration training stimulates the neurological system is responsible for this accelerated reaction.

It is often assumed that only athletes or advanced trainers require the effects of Myogenic Adaptation. However, everyone - especially the elderly - requires the same ability for their bodies to develop in order to maintain balance, strength and the ability to adapt to a surface that they would otherwise be unstable upon.

Blood Circulation

Whole Body Vibration training also increases blood circulation in the muscles. During contraction of a muscle group the capillaries are squeezed shut. They open to let blood through when the muscles relax. When you alternate contracting and relaxing a muscle, a natural muscle-pump mechanism is created, causing an increase in blood circulation.

In WBV training, depending on the selected frequency, muscles (and therefore capillaries) contract thirty to fifty times per second. The muscle-pump mechanism is thereby utilised at an optimum level and blood circulation improves.

This optimisation of blood circulation could be extremely beneficial to anyone suffering from a circulatory or peripheral vascular condition.

Influence on Bone Density

The negative effects of space travel and 'Zero Gravity' have been well documented and it is generally known that movement favourably influences the bone remodelling process. The level of resistance (load) influences the reconstruction and quality of the bone.

Bone responds better to dynamic rather than to static exercises. If load-induced local strains exceed the Minimal Effective Strain (MES) - the minimal amount of stimulus necessary to initiate new bone formation - then remodelling will be induced and bone mass is increased. However, if customary bone loading is decreased, or bone is subjected to disuse, its peak strains fall and the remodelling process will cease.

To avoid low bone mineral density in old age, it is recommended that people train to elevate their Peak Bone Mass - the maximum bone mass achieved during early adulthood - while the mechanisms for optimal bone growth are functioning at peak levels. This is accomplished by training variation and mechanical loading.

Mechanical loading is essential to the stimulation of bone mineral growth and consists of:

- Load magnitude - intensity
- Load rate - speed
- Load force - direction
- Load volume - set and repetition number.

As bone mineral content begins to diminish, the risk of fall-induced fractures increases. Osteopenia, the precursor to Osteoporosis, is defined as a bone mineral density between -1 and -2.5 standard deviations (SD); whereas Osteoporosis is a bone mineral density below -2.5 SD.

Several key factors have been linked to the loss of bone mineral density:

- Lack of physical activity
- Hormonal changes
- Dietary or nutritional intake
- Genetic predisposition

In most cases, it is very difficult - or even dangerous - to train the elderly with the required mechanical loads necessary for bone remodelling to occur. However, as research has shown (see appendix), the Power-Plate can safely achieve the loads necessary for bone remodelling.

Flexibility/Mobility

Nazarov, the first researcher to experiment extensively with WBV as a training method, was primarily concerned with its effect on flexibility. He found that stretch exercises with vibration gave a greater increase in flexibility than stretch exercises alone.

The underlying mechanism affecting flexibility was targeted through a shift of the pain threshold and the stimulation of Golgi Tendon Organs (GTOs). This causes the inhibition of the stretch reflex that we all feel when we stretch a muscle, thereby enabling us to increase the stretch.

Joint Mobility

The mobility of a joint is expressed by the number of degrees in its range of motion (ROM).

The importance of flexibility and mobility is often understated. However, it is estimated that as much as 99% of the adult population is already suffering from a muscle imbalance somewhere in the body, thus leading to the possibility of pain or tightness if left untreated.

Increased Hormone Production

In WBV training, the body is stimulated to produce increased quantities of Growth Hormones (GH), Insulin-like Growth Factor-I (IGF-I) and Testosterone in a very short space of time (eight to 12 minutes). There is also a dramatic decrease in Cortisol, the 'stress hormone', as well as an increase in the production of Neurotransmitters and Endorphins such as Serotonin and Neurotrophin. These changes are greater than those achieved through a conventional, intense power training session.

Due to the decrease in Cortisol levels, this hormonal response to WBV training has not been found to cause either a general stress reaction, or a response that is common for high-intensity exercise.

Massage

The heart and skeletal muscles, which make up 40 % of total body weight, ensure a rhythmic circulation of the blood. Microcirculation through the organs is also achieved through the muscles' ability to pump blood and the latest research studies show that healthy skeletal muscles oscillate at specific frequencies and amplitudes.

This synchronization of the skeletal muscle fibres, which are not visible to the naked eye, causes a pump and suction effect, supporting the heart and playing a determining role in the blood supply of the entire connective tissue.

Where the body is not functioning at an optimum level, WBV normalizes processes that are linked to the biochemical and physical rhythms, thereby initiating and stimulating the body's natural ability to heal itself.

Disease

It is well known that individuals suffering from conditions such as Arthritis, Parkinson's, Multiple Sclerosis, Diabetes, Osteoporosis and obesity, as well as many other conditions, benefit tremendously from physical activity.

Unfortunately, sufferers of these conditions are often unable to exercise due to loss of muscular strength, coordination or balance, joint pain and poor circulation. In many cases, they are also hindered by fear of embarrassment.

Because using a Power-Plate is so easy, the benefits of physical activity are now within reach for many of those not able to partake in conventional exercise such as walking, weight lifting or cycling. By stimulating the body's natural ability to increase muscular strength, balance, blood circulation, lymph system drainage, endocrine system response and bone mineral density, individuals are now able to fight the affects of many debilitating diseases.

Although, there are no cures for many of the conditions, the Power-Plate can provide relief from many of the symptoms suffered and hopefully a better quality of life.

Power-Plate proves effective for the elderly

Whole-Body-Vibration Training Increases Knee-Extension Strength and Speed of Movement in Older Woman.

Machteld Roelants, Sabine Verschueren & Christophe Delecluse
Katholieke Universiteit Leuven, Belgium

Published in the International Scientific Journal: **Journal of the American Geriatrics Society** (June 2004)

Results:

- 1. The first long-term study on the effects of Power-Plate training in older women clearly demonstrates that strength and speed of movement increases after 24 weeks of training on the Power-Plate.**
- 2. Power-Plate training proves to be a safe, suitable, and efficient strength-training method for the aging population. The findings of this study show that Power-Plate training has great potential for application in geriatric and therapeutic settings as a safe, low-impact strength training method. The low exertion and safety of loading elderly subjects may indicate Power-Plate for weakened populations, for those who are not attracted to or able to perform conventional resistance training.**

The hypothesis of this study was the great potential of Power-Plate in a therapeutic context, where it may enhance muscular performance in patients and older adults who are not attracted to or are not able to perform standard exercise programs. Maintaining muscle mass, functional strength and cardiovascular performance is a challenge for the elderly due to risk of potential overload and the diminished ability of the aging body to adapt to high levels of loading. Power-Plate provides a safe and easy opportunity to train these systems without excessive overload.

Muscle strength and peak muscle power have a great influence on the function of older adults in activities of daily living such as walking, climbing stairs, and rising from a chair. Common risk factors leading to falls and hip fractures in older adults are muscle weak-

ness and the inability of lower extremity muscles to produce rapid force. Older adults lose muscle mass with an age-related decrease in physical activity. Therefore, the prevention of age-related strength loss and muscle atrophy is a public health issue.

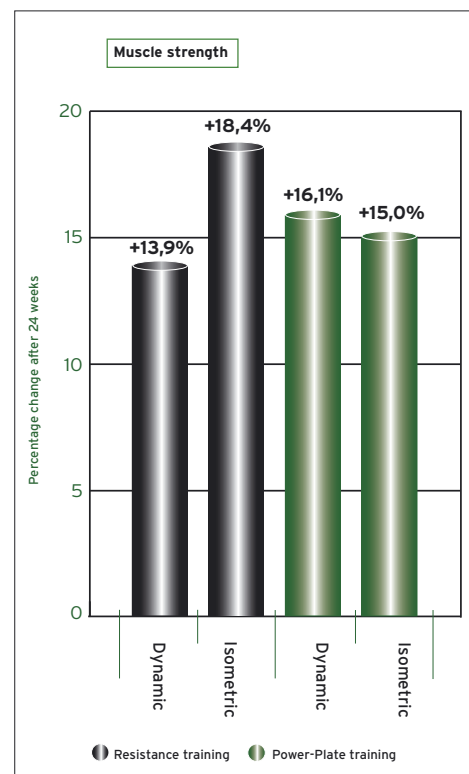


Fig. 1. Percentage change in muscle strength of the legs after 24 weeks for the Power-Plate training group and conventional resistance training group.

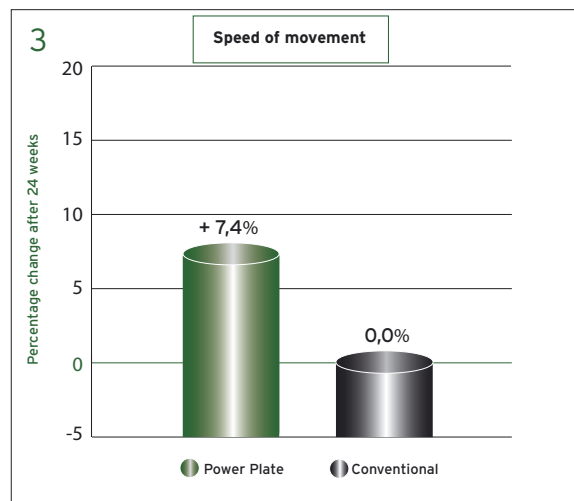
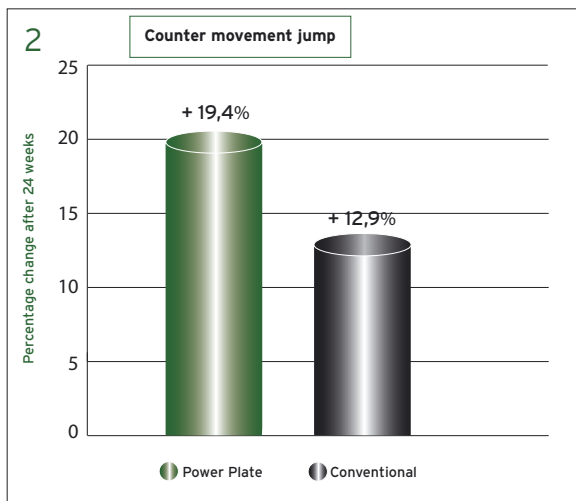


Fig. 2 + 3.

Change in performing the counter movement jump (fig. 2). The speed of movement increased only for the group that trained on the Power-Plate (fig. 3).

The research included 89 postmenopausal women between the ages of 58 -74 years old. Participants were randomly assigned to three groups: the Power-Plate group trained three times per week for 24 weeks; they performed a progressive program of static and dynamic knee extensor exercises such as squats and lunges. The conventional training group trained three times per week for 24 weeks; they performed dynamic leg press and leg extension exercises on conventional fitness equipment, increasing from low to high resistance. The control group did not participate in any training.

The results prove that both Power-Plate and conventional training increases muscle strength of the legs (fig. 1). Both groups also showed an improvement in performing the counter movement jump (fig. 2). The speed of movement increased only for the group that trained on the Power-Plate (fig. 3).

The counter movement jump is an accurate method for measuring (the stretch shortening) of the muscles, a system used in daily life such as rising from a chair, climbing stair or maintaining balance. Speed of movement is a very important measure of reaction and balance, and reduces the risk of falling .

Power-Plate exercises performed:



Exercise Variables

Training volume and training intensity of the Power-Plate training program:

	start	week 12	end
Duration (minutes)	3	20	30
Number of different exercises	2	6	9
Longest duration of vibration without rest (sec)	30	60	60
Rest between exercises	60	5	5
Amplitude (low/high)	low	high	high
Frequency (Hz)	35	40	40

Power-Plate training minimizes the need for conscious exertion and stress on the musculoskeletal, respiratory, and cardiovascular systems. Most subjects enjoyed the Power-Plate sessions, and did not consider it to be a difficult workout, and reported a moderate degree of muscle fatigue at the end of the session.

Power-Plate training builds bone

Research study shows that exercising on the Power-Plate may be the answer to osteoporosis: Power-Plate increases bone mineral density, improves strength, power and encourages fat loss in postmenopausal women.

This is a summary of a study published in **Journal of Bone and Mineral Research** (Vol. 19 (3), 2004)
Effect of 6-Month Whole Body Vibration Training on Hip Density, Muscle Strength and Postural Control in Postmenopausal Women: A Randomized Controlled Pilot Study

By Sabine Verscheuren, Machteld Roelants, Christophe Delecluse, Stephan Swinnen, Dirk Vanderscheuren & Steven Boonen, Katholieke Universiteit Leuven, Belgium.

Study Conclusions:
Power-Plate training leads to a significant (1.5%) increase in hip area bone density, also muscle strength and postural control increases in postmenopausal women.

These research findings present an exciting solution for an ever-worsening problem in our aging population: osteoporosis, loss of postural control and balance, bone fractures from falls, and difficult and incomplete recovery from traumatic falls.

As the average age of the world's population increases, we are faced with the increasing epidemic of osteoporosis. Each year in the U.S. more than 1.5 million people suffer from fractures due to early bone loss. One in three women and one in eight men will suffer from osteoporosis this year. In the U.S., 2.8 million men and women suffer from bone loss, 1 million have been diagnosed, while 1.8 million aren't even aware that they are losing integrity in the remodeling of their bones.

Initial studies on Power-Plate training showed increases in strength in test subjects. The Power-Plate causes the body's muscles to contract subconsciously at 30x to 50x per second, which can stimulate a power training effect while simply standing on the plate.

Three groups were studied:

The 90 participants - postmenopausal women ranging in age from 58 to 70 - were divided in three research groups.

1. The Power-Plate group trained 3 times per week, maximum 30 minutes per session, containing static and dynamic exercises for the upper leg and hip area, such as squats (the movement that allows you to sit down in a chair) and lunges.
2. The conventional weight training group trained 3 times per week, about one hour per session, including a separate warm-up and cool-down.
3. The control group did no training.

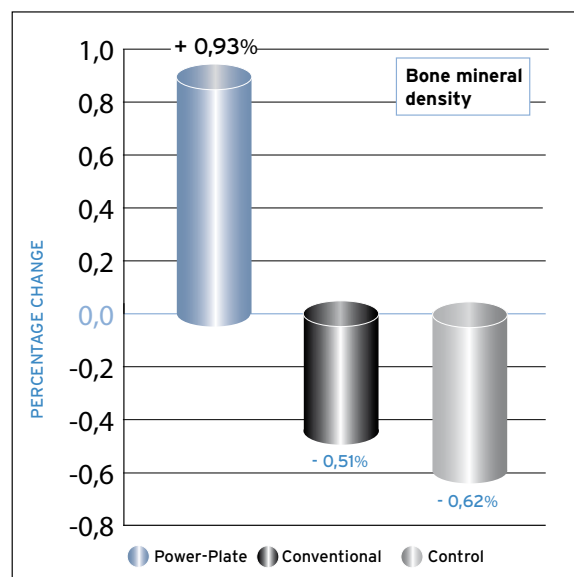


Fig. 1. Change in bone mineral density in the hip after 24 weeks of Power-Plate training compared to conventional strength training and the untrained control group.

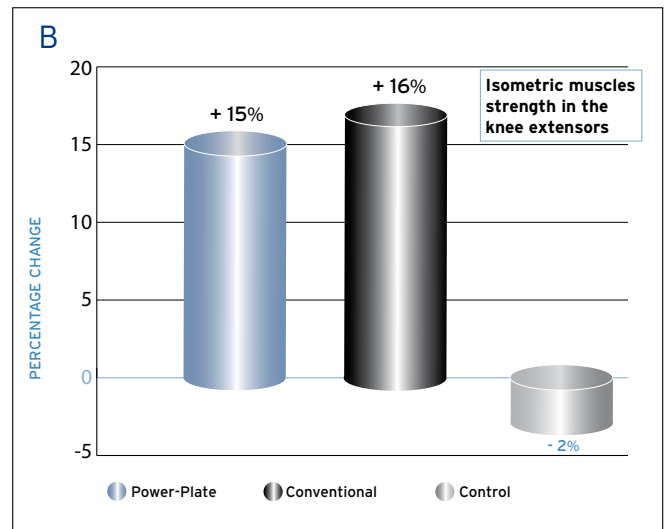
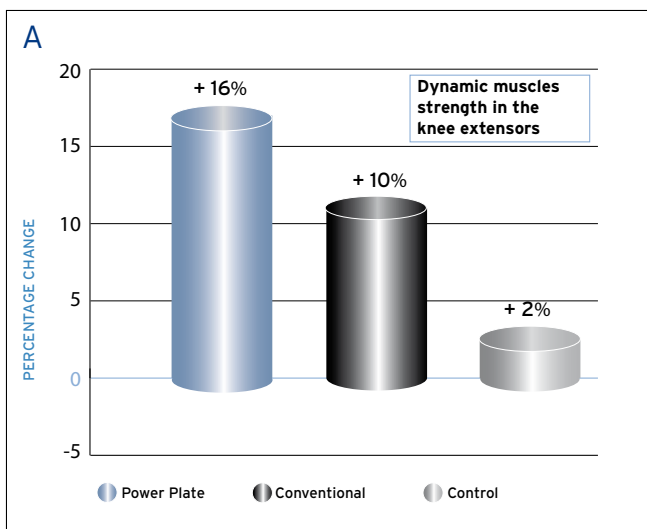


Fig. 2.

Change in dynamic (fig. 2a) and isometric (fig. 2b) strength in upper leg muscles for the Power-Plate group, the conventional training group, and the control group.

The Results:

The Power-Plate group got positive results: strength increased as much as 16% in upper leg muscles, while bone density at the hip increased 1.5%. And, as a bonus, the Power-Plate group showed an improvement in postural control and balance, they increased their muscle strength and lean mass while they lost body fat and fat mass.

The conventionally trained subjects were able to slow bone loss, which is consistent with published studies on weight training and bone loss.

The control group subjects continued to lose bone mineral density at the average rate.

How the Power-Plate was used:

The Power-Plate group performed workouts in 30 minutes or less, including static (still) and dynamic (moving) exercises for the upper leg and hip area.

The Power-Plate training variables started at the lowest (easiest) levels, and progressed with:

- * increased duration (exercise time)
- * increased number of exercises performed
- * shortened rest periods between exercises
- * increased frequency from 35Hz to 40Hz
- * increased amplitude from low to high



The conventional weight training group performed conventional weight training for a total of one hour per session, including a separate warm-up and cool-down.

Conclusion:

The Power-Plate training:

- * increases bone mineral density
- * is a viable solution to reverse bone loss and to eliminate osteoporosis
- * is an accessible training tool to help many populations prevent falls and fractures
- * increases strength
- * improves balance and equilibrium
- * improves posture
- * allows fat loss
- * improves health

The Power-Plate's low-strain, comfortable, safe, short-duration protocols may allow all populations to achieve strength and power training effects by just standing on the vibrating plate. In less than 30 minutes, three times per week, patients and exercisers can achieve strength, fat loss, better balance and reflexes, improved bone density and ultimately, greater health.

Strength Gains and Higher Jumps with Power-Plate

Research study shows Power-Plate brings strength gains and improved vertical jump height in 12 weeks compared to conventional strength training and to placebo.

This is a summary of a study published in **Medicine & Science in Sports & Exercise**[®], Vol. 35, No. 6, pp.1033-1041, © 2003, the Official Journal of the American College of Sports Medicine.

Strength Increase after Whole Body Vibration Training Compared with Resistance Training

By Christophe Delecluse, Machteld Roelantts & Sabine Verscheure, Katholieke University of Leuven, Leuven, Belgium.

Study Conclusions:

- The Power-Plate increases strength at least as effectively as conventional resistance training.
- Proof that the Power-Plate's strength increases are not due to the placebo effect.
- The Power-Plate enhances the body's sensory awareness and function, force production and vertical jump height (a measure of power).
- The study's previously untrained subjects found the Power-Plate workouts to create no adverse side effects. They found the workouts were enjoyable and not exhausting.
- The positive results suggest the indication of Power-Plate training for therapeutic uses with populations who may not be able to perform or are not attracted to strength training. This may provide safe, proactive, effective interventions to enhance wellness in many environments.

These research findings reveal exceptionally positive outcomes for many populations who wish to enhance their strength for activities of daily living. Benefits of Power-Plate's training are not exclusive to healthy untrained subjects, like those studied here. Benefits can be seen by anyone who wants to become or remain strong and perform better in life. Many populations such as geriatric, post-injury, rehabilitation, and performance athletes will benefit from the simple, effective exercises performed while standing on the Power-Plate.

Four groups were studied:

Sixty-seven untrained subjects were divided into four groups, and exercised three times per week for 12 weeks.

- The Power-Plate group used Power-Plate exclusively. They performed standing knee extensor exercises at a frequency of 35-40 Hz, such as lunges and squats (see pictures)
- The placebo group also used the Power-Plate, on a setting that did not generate vertical sinusoidal vibration. They felt a vibration, but it was too

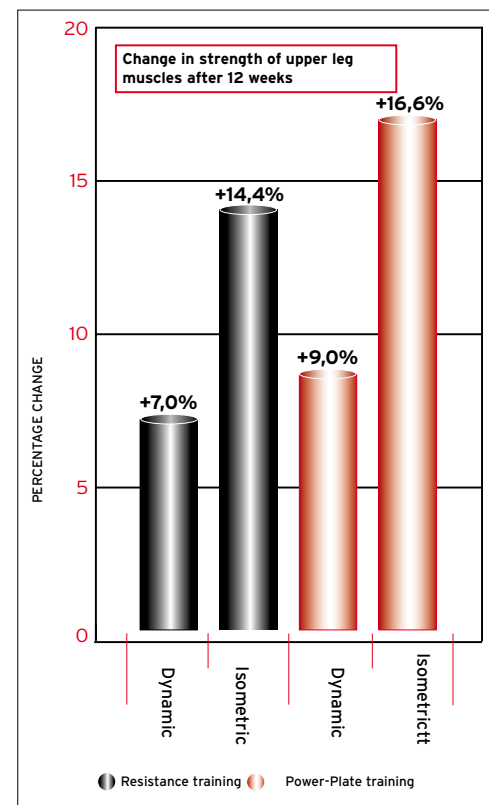


Fig. 1. Percentage change in strength of upper leg muscles (*M. rectus femoris*) after 12 weeks for the Power-Plate training group and conventional resistance training group.

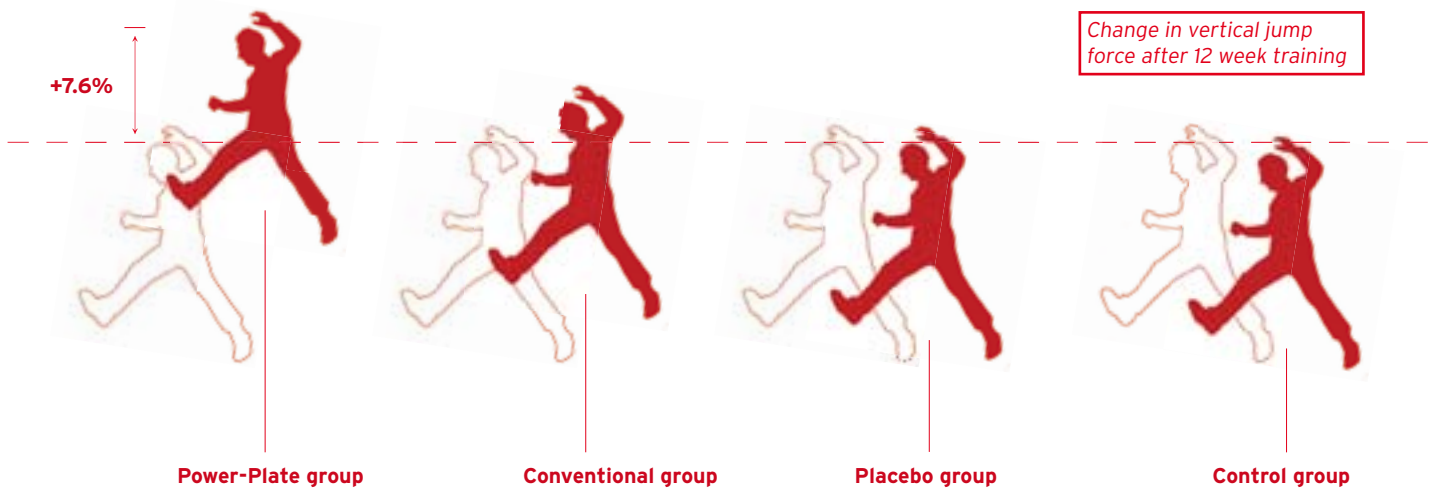


Fig. 2. Percentage change in vertical jump force after 12 weeks training for the four experimental groups.

□ Before training
 ■ After training

- subtle to elicit a training effect. They performed the same exercises as the Power-Plate group.
3. The resistance training group performed a cardio warm-up and knee extensor exercises on two conventional strength training machines.
 4. The control group did not participate in a training program.

Tests: The contractile properties of the knee extensors were evaluated at the start (pretest) and after 12 weeks (posttest). A dynamometer was used both pretest and posttest to measure isometric, dynamic and ballistic knee extensor strength on all subjects.

The Results:

The Power-Plate group achieved a **16.6%** gain in isometric strength of knee extensors, a **9%** increase in dynamic strength of the quadriceps muscles, and a **7.6%** increase in vertical jump height. There were no reports of adverse side effects. Most subjects found the vibration loading as enjoyable and fatiguing, but did not consider it a hard or exhausting workout.

The placebo group, using a placebo Power-Plate, did not achieve strength or power gains; they performed the same standing knee extensor exercises on a Power-Plate that created no vertical vibration loading.

The resistance training group achieved strength gains of 14.4% in isometric and 7.0% dynamic



strength were achieved, while there was no improvement in power and vertical jump height.

The control group did not increase in any of the measurements.

Conclusions:

Training on the Power-Plate has proven to be an efficient training stimulus to increase muscle strength.

In addition, it is likely that while Power-Plate's Whole Body Vibration requires little exertion and is enjoyable, it elicits a biological adaptation that is similar to that produced by resistance and explosive strength training.

The Power-Plate provides all the benefits of strength and power training, without the dangers of heavy loading, particularly for special populations who would not tolerate loading but will benefit from strength gains. The Power-Plate may be indicated for use in all strength training environments, and for varied populations.

This research suggests that Power-Plate has great potential in therapeutic environments where it can enhance muscle performance in rehabilitation patients and in the elderly, and in populations who may not be able to perform or be attracted to strength training. The Power-Plate can also enhance performance of athletes, as suggested by improved strength and vertical jump height.