

Training Book

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Everything you have always wanted to know about Whole Body Vibration, but were afraid to ask.



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CONTRA INDICATIONS

Important!

Please check the following list of 14 questions. If you can give a definite 'no' to all the questions, then you can start training on the Whole Body Vibration Machine. Otherwise, please receive advice from your physician first.

1. Do you suffer acute joint problems such as arthrosis or acute rheumatoid arthritis?
2. Do you have acute inflammations or infections?
3. Are you an epileptic?
4. Do you suffer from serious diabetes?
5. Do you have gallstones or kidney stones?
6. Do you have joint implants such as foot, knee and hip implants?
7. Do you suffer from cardiovascular disease?
8. Do you have heart valve disorders / heartbeat irregularities?
9. Do you have metallic or synthetic implants such as a
pacemaker or IUD?
10. Did you have a recent thrombosis or possible thrombotic disorders?
11. Do you have back problems such as hernia, discopathy, spondylolysis?
12. Do you have any tumors?
13. Do you have recent (operative) wounds, do you have recent inflammations?
14. Are you pregnant?
15. Do you suffer from intense migraine?
16. Do you suffer from VPPB?

INITIAL TRAINING:

- Before getting on the machine, make sure you read over the contra indications and make sure you do not have any of the medical issues listed. It is especially important for pregnant mothers to **NOT** use this equipment.
- Please go to the bathroom first.
- Try to touch your toes. Note how far you can go.
- Step on to the WBV machine, please use flat sole shoes or sandals with minimal cushioning.
 - First step on the platform and make sure your feet are equally spaced and straight.
 - The further out on you stand on the platform, the harder the workout.
 - Knees need to be bent, suck the tummy in and keep head erect (good posture)
 - Hold on to round bars.
 - See details for settings below.
 - For manual settings, select 88. (see below for more detail)
- Bend your knees further if your head is vibrating too much.
- Slowly bend and straighten up to feel the vibration going up your spine. This movement helps people with bad backs.
- Make sure you drink plenty of water after the session.
- Some people itch after the session because their blood is now flowing in the small capillaries.
- More is not better on these machines. I recommend starting with 10 minutes max.
- After the workout try to touch your toes. Note how much farther you can go.
- For noticeable benefits, please use at least 3x per week. Once per day is better.
- A minimum of 5 hours is recommended between sessions.
- Try and do the exercise before dinner. It is difficult on a full stomach.

SETTINGS

Programs setting

Type	Exercise cycle	Exercise time	Speed
Common fitness	1-3 times/day	5-20 mins	Average speed
Losing weight	4-8 times/day	10-20 mins	Lower speed

speed of programs

NOTE The figutes showed on the chart are power intensity

Program	10MINS	9MINS	8MINS	7MINS	6MINS	5MINS	4MINS	3MINS	2MINS	1MIN
P1	2	4	6	8	10	12	14	16	10	6
P2	1	2	3	4	5	6	14	10	8	6
P3	4	10	4	10	4	16	4	16	4	10

Manual settings:

The frequencies available are from 0-20. Each person will find their best combination of frequencies. I prefer to warm-up for 1 minute between 8 and 12, exercise between 16 and 20 and cool down between 12 and 10. Experiment with your own settings to find what your body likes.

We will be coming out with an entire set of targeted exercises with the corresponding stance and frequencies soon.

TARGET PROGRAMS

Fat loss and Toning

- For weight loss and toning it is important to engage as many of your muscle groups as possible with each session. As you build muscle mass in your body, your body will burn more fat. (Muscles require more energy to maintain)
- It is important to be regular with the exercise routine. Regularity is more important than intensity.
- Recommended use is 6 days a week with 1 day for muscle recuperation. Minimum 3 days a week.
- Do both the standing workouts and the upper body workouts. (Will be on video)
- Make sure you activate your abs the entire time you are on the machine. Pull the stomach up and in at the same time. This builds your core.
- Use the recommended upper body resistance bands as well. This will give you an arm workout while standing. Install a small metal coat hook facing upside down at the bottom of the vertical pedestal and hook the resistance bands around the hook. A kit will be available soon.
- Listen to relaxing tapes while working out. Lowering your stress hormone (cortisol) will go a long way to reducing fat accumulation. (We have that on our video)
- Be patient, most users do not notice anything for 30- 60 days. Focus on size, not weight as muscles weigh more than fat.
- Measure yourself before starting this program, thighs, waist, chest, hips and measure yourself after 30 days. You will be surprised!

STRENGTH TRAINING

For strength, one top frequency vibration training session repeated 10 times for one minute, with one-minute rest between "sets" shifts the force-velocity curve up and to the right, similarly to what's expected from high reps in the squat or leg press with relatively heavy loads.

For explosive strength, 10 days back-to-back of one session a day (10 times one minute vibration training with one-minute rest intervals) increases explosive strength comparable to making 200-drop jumps from 24 inches, twice a week, for a year.

Adding to an existing workout regime

Actually adding vibration training to a normal workout might prevent over training.

First of all, the circulation is improved, "flushing out" breakdown products of ammonia and lactic acid.

Second, vibration normalizes muscle tone and stimulates the production of local pain killing substances, which is a well-known application of vibration in general.

Third, the stimulation of hormones prevents over training, since the testosterone/cortisol ratio is a marker for over training

Fourth, vibration itself doesn't lead to muscle damage or soreness, since there's no eccentric load.

It can be used as a warm-up, e.g., 3 to 4 times one minute before weight training or any other workout.... It can also be used as a cooling-down method, e.g., 3 to 4 times one minute after a workout or competition.

TYPE OF VIBRATION USED IN OUR MACHINE

Currently there are two patterns of vibration available in the U.S. market, a triplanar pattern involving all three directional planes, and a very specific one directional, oscillating pattern based on the concept of a center fulcrum and an alternating right/left, up and down motion.

The tri-planar motion means the platform on which you stand moves forward, backward, left, right, up and down. The whole body is simply "shaken" in multiple directions.

The unique design of the center fulcrum motion means that while the right leg is forced upward and thus reflexively contracting, the left is lowered and relaxed. In this manner, the right and left lower extremities simultaneously contract and relax. In addition, the action provides for the simulation of the natural crossover, locomotor pattern that forms the basis for human walking or running. Most other vibration machines use a vertical vibration technique that is unproven and will cause dizziness or nausea in some users.

This pattern also allows for the stabilization of the spine and head, due to the left-right, natural tilting action of the pelvis, during locomotion. Vibrations to the head are hereby optimally reduced, which is essential for healthy WBV training. It can be said that this pattern is "vibration with a purpose, based on science."

HOW WHOLE BODY VIBRATION WORKS

- The Stretch Reflex

When a muscle fiber is stretched, it contracts by reflex (stretch reflex). By simply standing barefoot on the machine, vibration is generated and sent through your body, which passively stretches your muscles. This causes millions of muscle contractions, which increases muscle tone and size. As muscle density increases, your metabolic rate goes up, as an increase in muscle mass requires more energy.

The movement of the vibration plate simulates the body's natural 'stretch reflex' (Tonic Vibration Reflex). This is similar to the knee jerk reaction that occurs when the knee is tapped by a reflex hammer in a doctor's office. Without thinking about it, your body responds with a strong involuntary muscle contraction, leading to your leg 'kicking out'. With Whole Body Vibration technology, these strong muscle contractions can be repeated at a rapid rate.

- Acceleration and Amplitude

These two factors will directly influence the "results" the user can expect. Acceleration can be defined as the maximum speed of the platform during the upward motion. Amplitude is the vertical displacement of the platform from the lowest to highest point.

The amount of force received by the user is directly related to the mass, or body weight of the user, and the acceleration of the platform in the upward motion. Since the weight of the user is constant, the *greater the acceleration* of the platform upward, the *greater the force applied* to the user.

The greater the amplitude through which the force is applied, the greater the work done.

- Nearly 100% Muscle Recruitment

Due to its involuntary effect on muscle contraction, nearly 100% of the muscle fibers are recruited. Compare this to conventional training where there is only on average 40% muscle recruitment. This benefits the rehabilitation patient looking to add stability and strength to all muscles around their joints, to the athlete looking to maximize strength gains.

- Increased Blood Circulation

The gentle rapid contractions of up to 30 times per second allow the muscle to work as a pump in introducing blood to even the smallest blood vessels. This leads to the ability of the body to carry off waste products much faster, leading to increased peripheral circulation.

DOCUMENTED BENEFITS OF WHOLE BODY VIBRATION

- Muscle toning in legs, arms and abdomen.
- Core muscle conditioning and strengthening.
- Increased energy.
- Muscle stretching. (Reduced injury if used as a warm up)
- Improved digestion.
- Lymphatic drainage and microcirculation, which detoxifies and reduces congestion in your fat and cellulite, resulting in inches lost!
- Increased serotonin production, which helps combat Seasonal Affective Disorders.
- Enhanced endorphin release generating that feel good sensation which follows a traditional work out. (runners high)
- Increased production of Growth Hormones and all of its anti-aging benefits. (361%)
- Decreased production of Serum Cortisol. (The body's stress hormone) (32%)
- Enhanced bone density and bone building as the exercise is weight bearing.
- Body reshaping.
- Reduces pain and disability associated with osteoarthritis.
- Improves balance and coordination.
- Eliminates stress on joints, ligaments and tendons as compared to traditional exercise.
- Reduces acute and chronic lower back pain due to muscle strain and core muscle strengthening.
- Improves mobility due to the natural locomotor crossover pattern of the vibration.

HISTORY OF WHOLE BODY VIBRATION

Whole Body Vibration has been used as an exercise and therapeutic tool since the late 1800s. The research of this technology really began in the late 70's with the development of a vibration system by one of Russia's key sports scientists, Dr. Vladimir Nazarov. He was an active sportsman, a member of the Soviet gymnastics team and occupied a chair for sports biomechanics at the State College in Minsk. He first introduced this technology to competitive sports, ballet, and medicine in the former USSR. The Russian Space Program uses the technology with their astronauts suffering from considerable bone loss and poor muscle tone due to weightlessness.

Once communism fell in Russia, the secrets of Whole Body Vibration made its way to Europe in the early 1990's. Just like in Russia, other European athletes began using this form of effective exercise. In addition, the European Space Agency and NASA are actively using vibration in ongoing studies for the maintenance of muscle strength, mass, and bone density.

Now, Whole Body Vibration is being used in hospitals, physical therapy clinics, and rehabilitation facilities. Everyone from the elderly, the person with physical disabilities, to the general person looking to get toned is using this form of exercise. Due to its many benefits, the technology is quickly gaining acceptance by universities, professional sports teams, and health professionals in the rehabilitation and medical fields.

Vibration training has 40 years of research behind its science. With any technology, the individual needs to take a critical look at the research and validity behind it. Whole Body Vibration has been featured in such prestigious and influential peer reviewed journals as *Spine*, *Journal of Bone and Mineral Density*, and *Medicine & Science in Sports & Exercise*.

With its wide potential application, new research is constantly being initiated across numerous North American and European Universities. Since most Whole Body Vibration systems were developed in Europe, most of the peer-reviewed publications have come from there. At present there are nearly 100 articles dealing with the effects of and related benefits of Whole Body Vibration (WBV).

FAQ

1. Is vibration training safe?

Yes. Whole Body Vibration utilizes a very specific frequency range that is both proven in research and safe and effective. Every object has a resonance frequency. For example, internal organs and the spine have a resonance frequency between 5 and 20 Hz. Any vibration at a frequency of less than 20 Hz is NOT recommended. Whole Body Vibration stays within the safe range. This is why countless hours of exercise has been performed using Whole Body Vibration and there has been no detrimental value.

2. Is there research behind this technology?

Vibration training has 40 years of research behind it's science. With any technology, the individual needs to take a critical look at the research and validity behind it. Whole Body Vibration has been featured in such prestigious and influential peer reviewed journals as Spine, Journal of Bone and Mineral Density, and Medicine & Science in Sports & Exercise. With it's potential applications, new research is constantly being initiated across numerous North American and European Universities.

3. What makes whole body vibration exercise different from conventional training?

Whole Body Vibration has the competitive advantage over conventional training due to its ability to provide a more effective and efficient exercise without the constraints associated with regular training, such as joint stress, lengthy repetitions and time commitments. Research has shown similar strength gains to conventional resistance training at a fraction of the time. Fifteen minutes of Vibration exercise produces similar results to 1 hour in conventional training. In addition, there is less stress on the joints, ligaments and tendons with Vibration training when compared to regular resistance training. Therefore, Whole Body Vibration provides an effective solution to those that may benefit from weight training, but are unable to engage in normal exercise.

4. What is the science behind this type of exercise?

The science behind Vibration exercise follows several different principles:

The Stretch Reflex: The movement of the vibration plate with an amplitude of 4 mm simulates the body's natural 'stretch reflex' (Tonic Vibration Reflex). This is similar to the knee jerk reaction that occurs when the knee is tapped by a reflex hammer in a doctor's office. Without thinking about it, your body responds with a strong involuntary muscle contraction, leading to your leg 'kicking out'. With Whole Body Vibration technology, these strong muscle contractions can be repeated at a rapid rate. At a frequency of 6 to 30 times a second, Whole Body Vibration can produce up to 1800 muscle contractions in 1 minute.

4. What is the science behind this type of exercise?

Nearly 100% Muscle Recruitment: Due to its involuntary effect on muscle contraction, nearly 100% of the muscle fibers are recruited. Compare this to conventional training where there is only on average 40% muscle recruitment. This benefits the rehabilitation patient looking to add stability and strength to all muscles around their joints, to the athlete looking to maximize strength gains.

FAQ (CONT.)

Increased Blood Circulation: The gentle rapid contractions of up to 3000 times per minute allow the muscle to work as a pump in introducing blood to even the smallest blood vessels. This leads to the ability of the body to carry off waste products much faster, leading to increased peripheral circulation.

5. What is the age limit to Whole Body Vibration training?

There is no upper age limit to this type of exercise. By itself, it is not indicate a contraindication. Whole Body Vibration has many benefits for the elderly population, including positive effects on bone density, improvements in blood circulation, and increase in strength, balance and flexibility. All this is accomplished with less stress on the joints, tendons and ligaments than conventional exercise

6. What is the youngest age for vibration training?

We recommend following general guidelines on resistance training for adolescents. Taking this into consideration, we recommend an age limit of 12. However, there should always be supervision by a qualified individual. Any age less than 12 requires approval from a physician prior to any exercise

7. You state that using Whole Body Vibration is like weight training. Being a woman, I want to get more toned, but will I get bigger?

No. Getting bigger is mostly due to testosterone, which women do not have enough. Whole Body Vibration is designed to get you toned. You will begin replacing fat with muscle. This wont make you look bigger, but make you look slimmer.

8. What exactly is cellulite and how does Whole Body Vibration help with this?

Cellulite is sometimes termed 'cottage cheese'. This is not a problem for a certain group of people. This can happen to anyone at any age, regardless of whether you are skinny or overweight! Basically, cellulite is fat accumulation under the skin. This is usually in a honeycombed shaped pattern. In some people, this fat tends to bulge out like stuffing in a mattress. This is the 'cellulite' that you see.

In order to fight cellulite, an exercise program has to be specific. Basically, you must increase muscle tone, and replace fat stores with lean muscle. Most women know that doing high repetitions of exercise at all the possible angles is the best way to fight off cellulite. Whole Body Vibration is able to provide a very high rate of muscle contraction repetitions (3000 per minute). In addition, all muscle fibers are being worked.

9. I've heard people say that vibration exercise helps with anti aging. How is this possible?

There are many factors that go with aging. Inactivity and stress are two. This exercise practically takes 10 minutes a day, three times per week. Vibration exercise has been shown to decrease the stress hormone cortisol.

10. How many calories does using Whole Body Vibration burn?

Lets look at it another way. Our metabolism is unique to us. Metabolism is our body's ability to burn a certain number of calories a day. The higher our metabolism, the more calories a day we can burn every day. Whole Body Vibration exercise has been shown to increase our resting metabolism. To answer the question, vibration exercise will allow you, over time, to burn more calories per day than you did before starting vibration training. This will help in preventing a drop in metabolism if you wanted to lose weight, or allow you to be able to eat healthy and maintain your weight over time.

FAQ (CONT.)

11. I have osteoporosis. How can Whole Body Vibration help?

Vibration training helps by increasing the strength of your muscles. It's well known that the strength of the bones is influenced by the strength of your muscles. Vibration training is a safe and gentle way to achieve these strength gains. For further information, please go to the research section of this site for more information.

12. I have fibromyalgia and was told not to weight train. How does Whole Body Vibration help me?

An effective program for those with fibromyalgia will involve exercises that promote strength, flexibility and endurance. Vibration exercise has been shown to produce greater increases in flexibility over conventional training, with less stress on the joints. In addition, strength gains with vibration training are comparable to regular exercise, except the time to complete exercises is shorter. More importantly, vibration exercise has been shown to be gentle and safe, without putting undue stress on your joints. Consult your physician prior to starting any exercise program.

13. I have arthritis. Will Whole Body Vibration be helpful?

Exercise has shown to be beneficial for those with arthritis, with the goal of strengthening the muscles around the joints in keeping the area stabilized and to prevent further injury. Vibration exercise minimizes stress on the joints, making it an ideal exercise solution. Various health professionals have incorporated vibration training into their treatment plans. Once you are screened by your health professional, they will be able to recommend the appropriate vibration treatment regimen for your particular condition.

14. How often should I use it to see results?

Use of Whole Body Vibration is similar to regular training in some aspects. How often you use it will depend on what you are hoping to accomplish. For those looking for strength gains, we recommend approximately 3 times per week. Others may use it every day for recovery and warming up and cooling down. Due to its ability to increase circulation, lactic acid is quickly cleared, leading to faster recovery and ability to use it again.

APPLICATIONS

Medicine

Rehabilitation of force and power

Rehabilitation in Neurological patients

Muscle atrophy

Poor balance

Low back pain

Stress

Incontinence Osteoporosis

Blood flow problems

Applications focused on metabolism and tissue strengthening and recovery (arthrosis, tendonitis, skin problems).

Current studies under investigation at this moment: Treatment of the physical status of women after a breast cancer operation, patients with diabetes type2, rehabilitation of osteo-arthritis, tendonitis, muscle tears, and general recovery.

APPLICATIONS (CONT.)

Sports and Fitness

Increasing readiness before training or competition (scar tissue, poor blood flow, arousal) - Increasing effectiveness of (weight) training through Post Activation Potentiation. Enhancement of recovery after training
 Increasing taxability
 Enhancement of recovery after injury
 Overall body tone improvement and strength training

Corporate Environment

Increased overall energy levels
 Decreased stress
 Improved mood
 Short time commitment (10 minutes)
 Reduced need for stimulants (caffeine)
 Can be used in work clothes (no sweating)

OUR EQUIPMENT VS. POWER PLATE

	<u>Power Plate</u>	Pivtol Equipment
Date of Inception:	1999	1995

Frequency:	30 Hz - 60 Hz	5 Hz - 50 Hz
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Note: Although Power Plate sales reps are stating it is dangerous to go below 30 Hz, 16 of their 24 research listings showed improved performance while training below 30 Hz. In fact there is support for not training above 50 Hz as it will impede performance. These articles can be supplied upon request.

Vibration Pattern:	3 Planes (unproven)	1 Plane-proven/functional
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Note: Power Plate has yet to demonstrate that the additional 2 planes of motion they offer produce any significant training value. As an end load to the limb is required for activation of the stretch reflex, side-to-side and forward-backward vibration would seem to provide the user with no additional value. The teeter-totter motion of our equipment is truly a functional and proven way to stimulate muscle activity as the research has shown.

Crossover Pattern:	NO	YES- simulates walking
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Note: It is the unique teeter-totter motion that contributes to its effectiveness. The teeter-totter motion forces the pelvis into the same motion which functionally simulates the natural walking and running pattern.

Head/Eyes Affected:	YES (forces knee flexion)	NO
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The teeter-totter motion forces the pelvis into the same motion allowing for the spine to stabilize the head and eyes. Since the Power Plate does not provide for this functional motion, it is their vertical motion that affects the strong vibration in the head and eyes. This requires the Power Plate user into a forced flexed posture at the hips and knees in order to dampen the vertical vibration.

STUDIES

HORMONAL RESPONSES TO WHOLE BODY VIBRATION: C. Bosco • N. Iacorelli • O. Tsarpela • M. Cardittate M. Bordfazi • J. Tihammi • M. Viru A. De Lorenzo • A. Viru Sept 8 1999

Abstract : The aim of this study was to evaluate the acute responses of blood hormone concentrations and neuromuscular performance following whole-body vibration (WBV) treatment. Fourteen male subjects [mean SD) age 25 (4.6) years] were exposed to vertical sinusoidal WBV. 10 times for 60 s, with 60 s rest between the vibration sets (a rest period lasting 6 min was allowed after 5 vibration sets). Neuromuscular performance tests consisting of counter-movement jumps and maximal dynamic leg presses on a slide machine, performed with an extra load of 160% of the subject's body mass, and with both legs were administered before and immediately after the WBV.... In conclusion- we have shown that acute exposure to WBV causes increased plasma concentrations of T (Testosterone) and GH (Growth Hormone) and a decreased plasma concentration of C (Cortisol). The increases in neuromuscular effectiveness and T (Testosterone) concentration were simultaneous but independent responses; however the two phenomena may have a common mechanism.

LOW BACK: J. Rittweger, et al; Spine 2002 Sep 1:1829-34. "Treatment of chronic lower back pain with lumbar extension and whole-body vibration exercise: a randomized controlled trial"

STUDY DESIGN: A randomized controlled trial with a 6-month follow-up period was conducted. OBJECTIVE: To compare lumbar extension exercise and whole-body vibration exercise for chronic lower back pain. SUMMARY OF BACKGROUND DATA: Chronic lower back pain involves muscular as well as connective and neural systems. Different types of physiotherapy are applied for its treatment. Industrial vibration is regarded as a risk factor. Recently, vibration exercise has been developed as a new type of physiotherapy. It is thought to activate muscles via reflexes. METHODS: In this study, 60 patients with chronic lower back pain devoid of "specific" spine diseases, who had a mean age of 51.7 years and a pain history of 13.1 years, practiced either iso-dynamic lumbar extension or vibration exercise for 3 months. Outcome measures were lumbar extension torque, pain sensation (visual analog scale), and pain-related disability (pain disability index). RESULTS: A significant and comparable reduction in pain sensation and pain-related disability was observed in both groups. Lumbar extension torque increased significantly in the vibration exercise group (30.1 Nm/kg), but significantly more in the lumbar extension group (+59.2 Nm/kg; SEM 10.2; P < 0.05). No correlation was found between gain in lumbar torque and pain relief or pain-related disability (P > 0.2). CONCLUSIONS: The current data indicate that poor lumbar muscle force probably is not the exclusive cause of chronic lower back pain. Different types of exercise therapy tend to yield comparable results. Interestingly, well controlled vibration may be the cure rather than the cause of lower back pain.

CARDIOVASCULAR: J. Rittweger, et al; Int J Sports Mod 2002 Aug;23(6):428-32. "Oxygen uptake in whole-body vibration exercise: influence of vibration frequency, amplitude, and external load"

Vibration exercise (VbX) is a new type of physical training to increase muscle power. The present study was designed to assess the influence of whole-body VbX on metabolic power. Specific oxygen uptake ($\dot{V}O_2$) was assessed, testing the hypotheses that $\dot{V}O_2$ increases with the frequency of vibration (tested in 10 males) and with the amplitude (tested in 8 males), and that the VbX-related increase in $\dot{V}O_2$ is enhanced by increased muscle force (tested in 8 males). With a vibration amplitude of 5 mm, a linear increase in $\dot{V}O_2$ was found from frequencies 18 to 34 Hz (p < 0.01). Each vibration cycle evoked an oxygen consumption of approximately 2.5 micro I x kg (-1). At a vibration frequency of 26 Hz, $\dot{V}O_2$ increased more than proportionally with amplitudes from 2.5 to 7.5 mm. With an additional load of 40 % of the lean body mass attached to the waist, $\dot{V}O_2$ likewise increased significantly. A further increase was observed when the load was applied to the shoulders. The present findings indicate that metabolic power in whole body VbX can be parametrically controlled by frequency and amplitude, and by application of

STUDIES (CONT.)

additional loads. These results further substantiate the view that VbX enhances muscular metabolic power, and thus muscle activity.

STRENGTH & BALANCE: S. Torvinen, et al (Bone Research Group, UKK Institute, Tampere, Finland); *Clin. Physiol.* (2002) 22,145-152. "Effect of vibration exposure on muscular performance and body balance in a randomized cross-over study"

This randomized crossover study was designed to investigate the effects of a 4-min vibration bout on muscle performance and body balance in young, healthy subjects. Sixteen volunteers (eight men, eight women, age 24-33 years) underwent both the 4-min vibration- and sham-interventions in a randomized order on different days. Six performance tests (stability platform, grip strength, isometric extension strength of lower extremities, tandem-walk, vertical jump and shuttle run) were performed 10 min before (baseline), and 2 and 60 min after the intervention. The effect of vibration on the surface electromyography (EMG) of soleus, gastrocnemius and vastus lateralis muscles was also investigated. The vibration-loading, based on a tilting platform, induced a transient (significant at the 2-min test) 2.5% net benefit in the jump height ($P = 0.019$), 3.2% benefit in the isometric extension strength of lower extremities ($P=0.020$) and 15.7% improvement in the body balance ($P = 0.049$). In the other 2-min or in the 60-min tests, there were no statistically significant differences between the vibration- and sham-interventions. Decreased mean power frequency in EMG of all muscles during the vibration indicated evolving muscle fatigue, while the root mean square voltage of EMG signal increased in calf muscles. We have shown in this study that a single bout of whole body vibration transiently improves muscle performance of lower extremities and body balance in young healthy adults.

TRAINING: J. Rittweger, et al (Institut für Physiologie, Freie Universität Berlin, Germany); *Eur J Appl Physiol* (2001) 86: 169-173. "Oxygen uptake during whole-body vibration exercise: comparison with squatting as a slow voluntary movement"

In this study we investigated metabolic power during whole-body vibration exercise (VbX) compared to mild resistance exercise. Specific oxygen consumption ($\dot{V}O_2$) and subjectively perceived exertion (rating of perceived exertion, RPE; Borg scale) were assessed in 12 young healthy subjects (8 female and 4 male). The outcome parameters were assessed during the last minute of a 3-min exercise bout, which consisted of either (1) simple standing, (2) squatting in cycles of 6 s to 90 degrees knee flexion, and (3) squatting as before with an additional load of 40% of the subject's body weight (35% in females). Exercise types 1-3 were performed with (VbX+) and without (VbX-) platform vibration at a frequency of 26 Hz and an amplitude of 6 mm. Compared to the VbXcondition, the specific $\dot{V}O_2$ was increased with vibration by $4.5 \text{ ml} \times \text{min}^{-1} \times \text{kg}^{-1}$. Likewise, squatting and the additional load were factors that further increased $\dot{V}O_2$. Corresponding changes were observed in RPE. There was a correlation between VbX- and VbX+ values for exercise types 1-3 ($r = 0.90$). The correlation coefficient between squat/nosquat values ($r = 0.70$ without and $r = 0.71$ with the additional load) was significantly lower than that for VbX-/VbX+. Variation in specific $\dot{V}O_2$ was significantly higher in the squatting paradigm than with vibration. It is concluded that the increased metabolic power observed in association with VbX is due to muscular activity. It is likely that this muscular activity is easier to control between individuals than is simple squatting.

BLOOD-FLOW: Kersch-Schindl K, Grampp S, Hank C, Resch H, Preisinger E, Fialka-Moser V, Imhof H.: *Clin Physiol* 2001 May;21(3):377-82: "Whole-body vibration exercise leads to alterations in muscle blood volume."

... Occupationally used high-frequency vibration is supposed to have negative effects on blood flow and muscle strength. Conversely, low-frequency vibration used as a training tool appears to increase muscle strength, but nothing is known about its effects on peripheral circulation. The aim of this investigation was to quantify alterations in muscle blood volume after whole muscle vibration. Twenty healthy adults performed a 9-min standing test. They stood with both feet on a platform, producing oscillating mechanical vibrations of 26 Hz. Alterations in muscle blood volume of the quadriceps and gastrocnemius muscles were

STUDIES (CONT.)

assessed with power Doppler sonography and arterial blood flow of the popliteal artery with a Doppler ultrasound machine. Measurements were performed before and immediately after exercising. Power Doppler indices indicative of muscular blood circulation in the calf and thigh significantly increased after exercise. The mean blood flow velocity in the popliteal artery increased from 6.5 to 13.0 cm x s(-1) and its resistive index was significantly reduced. The results indicate that low-frequency vibration does not have the negative effects on peripheral circulation known from occupational high frequency vibration.

GERIATRIC STRENGTH & BALANCE: M. Runge, J. Musculoskeletal interactions 2000 (1): 54-58: "Balance training and exercise in geriatric patients "

We conducted a randomized controlled trial, n=34 (age: mean 67y, range 61-85yr) crossover design, intervention group 2 month training program three time a week (each session 3x2 minutes), performance tests of all participants every two weeks). The participants reached performance gains in chair rising of 18%, significantly different to the value of the controls. We interpreted the findings as improvements in muscle power of functional relevance by the oscillative muscle stimulation. We observed no serious side effects...

CARDIO-VASCULAR: J. Rittweger, et al; Clin. Physiology 2000; 20 (2),134-142. "Acute effects of exhaustive vibration exercise"

... Vibration exercise (VE) is a new neuromuscular training method that is applied in athletes as well as in prevention and therapy of osteoporosis. The present study explored the physiological mechanisms of fatigue by VE in 37 young healthy subjects. Exercise and cardiovascular data were compared to progressive bicycle ergometry until exhaustion. VE was performed in two sessions, with a 26 Hz vibration on a ground plate, in combination with squatting plus additional load (40% of body weight). After VE, subjectively perceived exertion on Borg's scale was 18, and thus as high as after bicycle ergometry. Heart rate after VE increased to 128 min t1, blood pressure to 132/52 mmHg, and lactate to 3.5 mM. Oxygen uptake In VE was 48.8% of V02max in bicycle ergometry. After VE, voluntary force in knee extension was reduced by 9.2%, jump height by 9.1%, and the decrease of EMG median frequency during maximal voluntary contraction was attenuated. The reproducibility in the two VE sessions was quite good: for heart rate, oxygen uptake and reduction in jump height, correlation coefficients of values from session I and from session 2 were between 0.67 and 0.7. Thus, VE can be well controlled in terms of these parameters.

Surprisingly, an itching erythema was found in about half of the individuals, and an increase in cutaneous blood flow. It follows that exhaustive whole-body VE elicits a mild cardiovascular exertion, and that neural as well as muscular mechanisms of fatigue may play a role.

STRENGTH: Mester J, Spitzsnfeii P, Schwarzer J, Seifriz F. (Institute for Theory and Practice of Training and Movement, German Sport University, Cologne); J Sci Mod Sport 1999 Oct;2(3):211-26: "Biological reaction to vibration-implications for sport."

In many situations of everyday life, vibration load occurs. Here whole body vibration in vehicles, such as boats, cars, helicopters and others as well as hand-transmitted vibration (motor saws etc.) can be named. As vibration is assumed liable to cause various threats to human health, a great number of studies in work science focused on dose-effect relations and concepts for prevention. Although in many sports remarkable vibration load also occurs, there is very little research on the potential dangers and benefits of vibration stimuli, e.g, on whole body vibration and the implications for muscular activity and neuromuscular control in sport. In personal studies the damping behavior and training effects under whole body vibration were

STUDIES (CONT.)

investigated. Various research areas have been studied in order to approach the relevant topics: neuromuscular and posture control, energy metabolism in terms of oxygen uptake under whole body

vibration and local concentration of phosphates by means of ^{31}P -MRS. Furthermore the effects of strength training under whole body vibration were analyzed.

The results underline that vibration is a neglected research topic in sport science from the preventive point of view as well as from the one focusing on the improvement of sport performance.

STRENGTH & POWER: C.Bosco, et al; Clin. Physiol. 19 (1999) 2; 183-187 "Adaptive responses of human skeletal muscle to vibration exposure"

The aim of this study was to investigate the effects of whole-body vibrations (WBV) on the mechanical behavior of human skeletal muscle. For this purpose, six female volleyball players at national level were recruited voluntarily. They were tested with maximal dynamic leg press exercise on a slide machine with extra loads of 70, 90, 110 and 130 kg. After the testing, one leg was randomly assigned to the control treatment (C) and the other to the experimental treatment (E) consisting of vibrations. The subjects were then retested at the end of the treatment using the leg press. Results showed remarkable and statistically significant enhancement of the experimental treatment in average velocity (AV), average force (AF) and average power (AP) ($P < 0.05$ -A.005). Consequently, the velocity-force and power-force relationship shifted to the right after the treatment. In conclusion, it was affirmed that the enhancement could be caused by neural factors, as athletes were well accustomed to the leg press exercise and the learning effect was minimized.

NEUROMUSCULAR: C.Bosco, et al; Clin. Physiol. 19 (1999) 2; 183-187 "The influence of whole body vibration on the mechanical behavior of skeletal muscle"

The aim of this study was to investigate the effects of whole body vibrations on the mechanical behavior of human skeletal muscles... Results showed remarkable and statistically significant enhancement in the EG of the height of the best jump, the mechanical power of the best jump and the average jumping height during 5s Cj. In contrast, no statistically significant variations were noted in the CG. Consequently, it was suggested that the effect of WBV treatment elicit fast biological adaptation connected to neural potentiation.

NEUROMUSCULAR: C.Bosco, et al; Eur. J. Appl. Physiol. 79 (1999); 306-311 "Influence of vibration on mechanical power and EMG activity in human arm flexor muscles"

...The aim of this study was to evaluate the influence of vibration on the mechanical properties of arm flexors. ... The results showed statistically significant enhancement of the average power in the arm treated with vibrations. The root mean square electromyogram (EMGs) had not changed following the treatment but, when divided by mechanical power, (P) as an index of neural efficiency, it showed statistically significant increases. It was concluded that mechanical vibrations enhanced muscle P and decreased the related EMG/P relationship in elite athletes. Moreover, the analysis of EMGs recorded before the treatment and during the treatment itself showed an enormous increase in neural activity during vibration up to more than twice the baseline values. This would indicate that this type of treatment is able to stimulate the neuromuscular system more than other treatments used to improve neuromuscular properties.

NEURAL REHABILITATION: J. Gianutsos, et al; [research \(Poster 222\)](#) from the New York School of Medicine presented at the AAPMR: "Motor Rehabilitation of Spinal Cord Dysfunction by means of Whole Body Vibration"

STUDIES (CONT.)

Objective: To explore (1) the efficacy of whole body vibration (WBV) in inducing reflex standing and, specifically, (2) the progress of persons with spinal cord dysfunction of 3 differing etiologies. Design: Case series. Setting: Rehabilitation center in a metropolitan area. Patients: Persons with spinal paralysis of various etiologies who were otherwise unable to stand without the use of long-leg braces locked at the knee. Case 1: a 21-year-old man who underwent laminectomy at T2-9 for resection of an intramedullary tumor. Case 2: a

12-year-old boy presented with quadriplegia secondary to transverse myelitis. Case 3: a 24-year-old man with CS American Spinal Injury Association class A tetraplegia for 5 years secondary to a fall. Interventions: WBV to produce rapid, mechanically delivered repetitive stretches to the lower extremities, thereby resulting in involuntary muscle contraction. Main Outcome Measures: Standing time with and without WBV, degree of volitional movement, trunk, and body control, ability to transfer, and carry over to voluntary standing and walking. Results: All 3 patients were able to stand with minimal assistance and to increase progressively the length of standing time. Eventually, 2 were able to walk independently using various ambulatory aids. Conclusions: WBV represents a promising modality for use in the rehabilitation of persons with motor dysfunction of spinal origin.

GERIATRICS: M.Runge: " the multifactorial etiology of gait disorders, falls, and hip fractures In the elderly "

Age, gait disorders, falls, and hip fractures are connected in a pathological cascade. 90 % of hip fractures happen at the age of 70 and older; 90 % are a consequence of a fall. Only a minority of these patients regains their former level of locomotion. For many of them a hip fracture ends in dependence on personal help, placement in a nursing home, or even death. About 80 % of falls occur due to pathological balance and gait disorder and are not due to syncope or overwhelming external force. 5 % of all falls result in a fracture, including 1°k of all falls with hip fractures. What determined the fracture risk is the relation of bone fragility to geometrical and physical factors of the fall. Regarding the cascade gait disorder-fall-hip fracture, there are always multiple factors inter-acting. It is useful to give this distinct Entity of multifactorial gait disorder with high risk of falling a new diagnostic label: We suggest "age-associated multifactorial gait disorder." To identify individual risk factors and regard their interactions can be a basis for therapy and interventions to prevent falls.