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Where's the Data?

We've all been exposed to different ideas about training and recovery. There are different camps and advocates for a range of positions.

For example, some people have argued that overtraining is essentially a myth and that recovering from training is a simple process that occurs very quickly. Others have advocated for special recovery techniques or 'easy training' to speed recovery.

Some people claim that only certain exercises such as the squat that are performed in specific ways can result in good strength gains and muscular hypertrophy. Others have claimed that to produce muscular hypertrophy it is essential to train with many sets and limited time between sets.

"Training and recovery are scientific areas of inquiry."

Still, more recently, people have claimed with extravagant ads in the world's leading newspapers that people can increase strength and produce muscular hypertrophy without training at all. The only requirement is that a person stands on a vibrating board in what is called 'whole body vibration training'. It is claimed that no one knows how it works, but the effects are 'miraculous'.

What often is not mentioned in all these claims is that training and recovery have been and are scientific areas of inquiry. The data, the evidence, for any claim and any factor or variable can be assessed based on quality studies. In fact, as shown in prior issues training, variables such as volume, intensity, frequency, time under tension for resistance training, and modality of exercise have been researched for decades. We do know a lot about these training variables.

When we treat training and recovery as areas of scientific inquiry, we then can follow through on our assessment of the scientific validity of any claim by asking a simple question: 'Where's the data?'

In this issue, this question is asked about the claims made for:

1. positive effects of whole-body vibration training,
2. certain strategies to speed up recovery from training,
3. specific resistance training protocols to increase endogenous hormones as an essential factor for strength gains and muscular hypertrophy. ◆

In This Issue

Features

Departments

Whole-Body Vibration: What Does the Research Say?

By Matt Brzycki, Princeton University

One of the latest methods of training is whole-body vibration (WBV). The use of WBV is becoming increasingly popular among a wide range of populations from the athletic to the elderly.

WBV has two main elements. One is the vibration that comes from a vibration device or platform. The other is the exercise/activity. WBV can be done using a single leg or both legs; static or dynamic contractions; or unloaded or loaded conditions (with additional weight).

WBV is touted as an effective way to prevent and treat osteoporosis and muscle atrophy as well as improve 'muscle performance', 'athletic power' and 'body balance'. In describing its vibration device, Soloflex® ran a series of advertisements in *The New York Times*. One said, in part, 'It only takes ten minutes a day and all you have to do is stand on it. Will miracles never cease!'

MASTER TRAINER focuses on information about lifetime bodybuilding, master athletics, and health and fitness. Information reflects the author's opinions as well as summaries of books, articles, and recent scientific news. This publication does **not** provide medical advice for specific medical problems. Medical advice should be obtained from medical personnel.

The Research

If even part of the hype is true, WBV would be quite a miracle. As with most methods of training, anecdotal reports are one thing and scientific studies are another. Let's take a look at some of the research on the safety and efficacy of WBV.

Bosco and Co-Workers (1998)[1]

In this study, researchers investigated the effects of WBV on the 'mechanical behavior' of muscle. The study involved 14 physically active students (gender unspecified; average age 20.2). The subjects were randomly assigned to one of two groups: One group did WBV and the other group served as a control. The subjects in the experimental group performed one session per day for 10 days. The control group didn't participate in any training other than their 'regular technical and tactical training in handball or water polo three times per week.' It's unclear whether or not the experimental group continued to do the same type of training. (The subjects from both groups were participants in handball and water polo.)

The subjects stood with one foot or both feet on a vibration platform. While standing on the platform, the subjects did five exercises/activities: standing in an erect position, standing in a half-squat position (knee angle unspecified), standing with the feet rotated externally (knee angle 90 degrees), standing on one leg on the right side of the platform (knee angle 90 degrees) and standing on the other leg on the left side of the platform (knee angle 90 degrees). Each of the five exercises/activities was done for 90 seconds with 40 seconds of recovery between each exposure. Over the course of 10 days, the volume was increased systematically by increasing the duration of vibration in each exercise/activity by five seconds every day up to a total of two minutes. In effect, the subjects received 91 minutes and 25 seconds of vibration (at 26 Hertz or Hz) over the course of 10 sessions.

WBV produced a 'remarkable and significant enhancement' in the highest rise of the center of gravity, maximal mechanical power and average height during continuous jumping for five seconds. However, the WBV group didn't improve average mechanical power during continuous jumping for five seconds.

A drawback of the study was the small number of subjects. It should be noted that the lead researcher – Carmelo Bosco – now has an internationally patented vibration system that's named after him: The NEMES™ Bosco-System™.

Bosco and Co-Workers (1999) [2]

This study investigated the acute effects of WBV on the 'mechanical behavior' of muscle. The study involved six female volleyball players (average age 19.5) at the national level. For each subject, one leg was randomly assigned to an experimental condition while the other leg served as a control.

The subjects stood with the toes of one foot on a vibration platform while keeping that knee in a static position at an angle of 100 degrees; the other leg was held off the ground. The experimental leg was exposed to one minute of vibration for a total of 10 times with one minute of recovery between each exposure. In effect, the experimental leg received 10 minutes of vibration (at 26 Hz).

Immediately after completing the experimental condition, WBV produced a 'remarkable and statistically significant enhancement' in average velocity, force and power during a dynamic leg press on a slide machine with loads of 154, 198, 242 and 286 pounds. (One small exception: The average force produced with 154 pounds improved slightly, not significantly.)

A major drawback of this study was that the vibration training wasn't compared to another type of training. As a result, it's impossible to tell if the improvement in performance was due to the vibration from the platform or the activity that was done on the platform. Another drawback was the small number of subjects. In addition, the subjects were given three trials with each load. Rather than taking the average of the three trials, the researchers used the best of the three measurements. It's quite possible that using the average of the three measurements could have produced considerably different results.

Rittweger, Beller and Felsenberg (2000) [3]

In this study, researchers compared the acute effects of WBV and bicycle ergometry on cardiovascular function. The study involved 37 healthy subjects (16 women and 21 men; average age 23.5). All subjects were assigned to perform vibration training and bicycle ergometry.

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The subjects stood with both feet on a vibration platform with an extra load secured to their waists (35% of bodyweight for women and 40% of bodyweight for men). After standing for 30 seconds, they squatted 'until exhaustion' using a repetition duration of three seconds up and three seconds down. Each subject did this protocol twice (during two sessions that were conducted at least eight days apart). The average time to exhaustion – essentially, the time of exposure to vibration – was 5:25 in the first session and 6:02 in the second (at 26 Hz).

The average time to exhaustion on a stationary bicycle was 12:23. This activity produced significantly higher heart rates than both sessions of vibration training (171 beats per minute compared to 128 and 129 beats per minute) and oxygen intake (44.8 ml/kg/min compared to 21.3 and 22.1 ml/kg/min).

Interestingly, the researchers reported that a number of subjects 'showed considerable erythema on their legs, often sharply delineated like stockings'. (Erythema is an abnormal redness of the skin; it's a primary indicator of inflammation.) Also seen was edema (swelling) over the foot and tibia. Finally, many subjects reported itching of the leg after about 1 - 2 minutes of vibration.

Torvinen and Co-Workers (2002) [4]

This randomized, crossover study examined the acute effects of WBV on 'muscle performance' and 'body balance'. The study involved 16 healthy subjects (eight women and eight men; aged 18 - 35). The design of this study was such that the subjects also acted as their own controls, receiving sham vibration.

The subjects stood with both feet on a vibration platform. While standing on the platform, the subjects did six exercises/activities: light squatting, standing in an erect position, standing in a relaxed position with slightly flexed knees (angle unspecified), light jumping, alternating the bodyweight from one leg to the other and standing on the heels. Each of the six exercises/activities was done for 10 seconds and the sequence was repeated four times. The recovery period between each exposure was unspecified. In effect, the subjects received four minutes of vibration (at 25 Hz for the first minute, 30 Hz for the second minute, 35 Hz for the third minute and 40 Hz for the fourth minute). The subjects also performed the same protocol on the platform without it vibrating.

Within two minutes and 60 minutes of completing the experimental condition, WBV didn't produce a significant improvement in maximal isometric strength of the quadriceps, vertical jump, grip strength or stability/balance. Moreover, WBV didn't produce a significant improvement in dynamic balance or agility (based upon a tandem walk and shuttle run tests).

Delecluse, Roelants and Verschueren (2003) [5]

In this study, researchers compared the effects of WBV and resistance training on muscular strength. The study involved 67 untrained females (average age 21.4). The subjects were randomly assigned to one of three experimental groups: One group did WBV, another group received a placebo (sham) vibration and the third group did resistance training. A fourth group served as a control and didn't participate in any training. The subjects in the experimental groups performed their assigned training three times per week for 12 weeks with at least one day of recovery between each session.

The subjects in the WBV and placebo groups stood with one foot or both feet on a vibration platform. While standing on the platform, the subjects did five static and dynamic exercises: the squat, deep squat, wide-stance squat, one-legged squat and lunge. Over the course of 12 weeks, the volume was increased systematically by increasing the duration of vibration in one session (from three minutes to 20 minutes), the number of series of one exercise (from one to three) or the number of different exercises (from two to six); the intensity was increased by shortening the recovery periods (from one minute to five seconds) or increasing the amplitude and/or frequency of the vibration (from 35 to 40 Hz). The subjects in the placebo group could hear the motor but experienced negligible vibration.

The resistance-training group performed a 'moderate' program that consisted of the leg press and leg extension. The subjects used a load of 20-RM in Weeks 0 - 2, 15-RM in Weeks 3 - 5, 12-RM in Weeks 6 - 8 and 10-RM in Weeks 9 - 12. The exercises were done to 'fatigue failure' for the prescribed number of repetitions. They did two sets of each exercise with at least one minute of recovery between each set. When the subjects could do at least two repetitions more than the prescribed number, they were instructed to increase the resistance for the next set or in a subsequent session.

The WBV and resistance-training groups had significant increases in the isometric and dynamic strength of the quadriceps. There were no significant differences between the two groups. The WBV group was the only one to experience a significant increase in vertical jump. Neither the WBV

group nor the resistance-training group had a significant improvement in ballistic strength. The placebo and control groups didn't experience any significant improvement in any measure.

Despite doing the same number of sessions, the WBV group performed different exercises and used a greater volume of training than the resistance-training group. This makes it impossible to make any comparisons between – and conclusions about – the two methods of training. Also of note is that in the pre-test, the resistance-training group had a significantly higher performance than the WBV group. Thus, the potential for improvement was lower in the resistance-training group and likely affected their performance. It must also be mentioned that the research was 'technically supported' by a company that manufacturers a vibration platform (which was used in the study).

de Ruiter and Co-Workers (2003a) [6]

This study looked at the acute effects of WBV on muscle activation. The study involved 12 untrained students (five women and seven men; average age 23.3). There was no control group.

The subjects stood with both feet on a vibration platform while keeping their knees in a static position at an angle of 110 degrees. They were exposed to one minute of vibration for a total of five times with two minutes of recovery between each exposure. In effect, the subjects received five minutes of vibration (at 30 Hz).

Within 90 seconds of completing the experimental condition, there was a significant decline in voluntary activation of the quadriceps. This measure was still depressed three hours after performing WBV.

As part of the same study, 10 subjects did an additional five sessions of WBV in a two-week period with two days of recovery between each session. The sessions consisted of the same vibration protocol as described earlier.

After two weeks of WBV (six sessions), there was no improvement in muscle activation during maximal isometric force production and maximal rate of isometric force rise of the quadriceps.

de Ruiter and Co-Workers (2003b) [7]

In this study, researchers investigated the effects of WBV on muscle activation and/or contractile properties and vertical jump. The study involved 20 healthy students (eight women and 12 men; average age 20.3). The subjects were assigned to one of two groups: One group did WBV and the other group served as a control. The subjects in the WBV group performed three sessions per week for 11 weeks. (The study lasted longer than 11 weeks but no training was done during Weeks 5 and 6.) The subjects did five sets in Weeks 0 - 2, six sets in Weeks 3 - 4 and Week 7, seven sets in Weeks 8 - 10 and eight sets in Weeks 11 - 12.

The subjects stood with both feet on a vibration platform while keeping their knees in a static position at an angle of 110 degrees. They were exposed to one minute of vibration for a total of 5 - 8 times (as just noted) with one minute of recovery between each exposure. In effect, the subjects received 210 minutes of vibration (at 30 Hz) over the course of 33 sessions. The subjects in the control group followed the same protocol but stood beside the platform.

WBV produced a significant improvement in stimulated maximal rate of isometric force rise of the quadriceps. However, the WBV group didn't improve isometric muscle force, voluntary activation or maximal rate of voluntary force rise of the quadriceps or vertical jump more than the control group. Of note is that one subject in the WBV group developed "shin pains" and dropped out of the study.

Roelants and Co-Workers (2004) [8]

This study compared the effects of WBV and 'fitness training' on body composition and muscular strength. The study involved 48 untrained female students (average age 21.3). The subjects were assigned to one of two experimental groups: One group did WBV and the other did fitness training (cardiovascular and resistance training). A third group served as a control and didn't participate in any training. The subjects in the experimental groups performed their assigned training three times per week for 24 weeks with at least one day of recovery between each session.

The subjects in the WBV group stood with one foot or both feet on a vibration platform. While standing on the platform, the subjects did four static and dynamic exercises: the high squat, deep squat, lunge and bicep curl. Over the course of 24 weeks, the volume was increased systematically by increasing the duration of vibration in one session (from three minutes to 20 minutes), the number of series

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of one exercise (unspecified) or the number of exercises for one muscle group (from one to three); the intensity was increased by shortening the recovery periods (from one minute to five seconds) or increasing the amplitude and/or frequency of the vibration (from 35 to 45 Hz).

The subjects in the fitness group performed cardiovascular training on a bicycle, step or treadmill. The duration was increased systematically from 15 minutes to 40 minutes per session; the intensity varied between 60 - 80% of heart-rate reserve. The subjects in the fitness group also performed total-body workouts including the leg press and leg extension. The subjects started with a load of 20-RM and increased to 8-RM. They did two sets of each exercise. The amount of recovery between each set wasn't specified.

*"Research shows that the effects of WBV are **not** miraculous."*

The WBV group had a significant (but small) increase in fat-free (lean-body) mass (from 98.12 pounds to 100.32 pounds). However, this wasn't significantly different from that of the fitness or control groups. In addition, the WBV group had an increase in fat mass (from 39.60 pounds to 41.14 pounds) and percentage of body fat (from 28.3% to 28.6%). Meanwhile, the fitness and control groups had a decrease in percentage of body fat (from 25.8% to 24.8% and 26.8% to 26.5%, respectively). There were no significant differences in the improvement of quadriceps strength between the WBV group and the fitness group at any of the velocities tested (0, 50, 100 and 150 degrees).

A drawback of the study was that the subjects got to choose the type of training that they preferred. This may have influenced their motivation throughout the course of the study, particularly if they felt that their choice was a bad decision.

Roelants, Delecluse and Verschueren (2004) [9]

In this study, researchers compared the effects of WBV and resistance training on muscular strength, speed of movement and vertical jump. The study involved 89 postmenopausal women (aged 58 - 74). The subjects were randomly assigned to one of two experimental groups: One group did WBV and the other did resistance training. A third group served as a control and didn't participate in any training. The subjects in the experimental groups performed their assigned training three times per week for 24 weeks with at least one day of recovery between each session.

The subjects in the WBV group stood with one foot or both feet on a vibration platform. While standing on the platform, the subjects did four static and dynamic exercises: the high squat (knee angle between 120 and 130 degrees), deep squat (knee angle 90 degrees), wide-stance squat and lunge. Over the course of 24 weeks, the volume was increased systematically by increasing the duration of vibration in one session (from three minutes to 30 minutes), the number of series of one exercise (from one to three) or the number of different exercises (from two to nine); the intensity was increased by shortening the recovery periods (from one minute to five seconds), increasing the amplitude and/or frequency of the vibration (from 35 to 40 Hz) or changing the manner in which the exercises were done (from two legs to one leg).

The subjects in the resistance-training group performed total-body workouts that included the leg press and leg extension. The load consisted of 20-RM for the first two weeks and 10-RM - 15-RM for the next 12 weeks. They did two sets of each exercise. The load varied between three sets of 12-RM and one set of 8-RM in the last 10 weeks. The amount of recovery between each set wasn't specified.

WBV had a significant increase in isometric and dynamic strength of the quadriceps, speed of movement during a leg extension with 1% and 20% of isometric maximum (but not with 40% or 60% of isometric maximum) and vertical jump. However, there was no significant difference between any improvements made by the WBV group and that of the resistance-training group.

Subjects in the WBV group reported 'some' erythema, edema and itching of the legs in the first sessions. Also of note is that the authors concluded that 'WBV training in older women is a safe, suitable and efficient strength-training method'. Yet earlier on the same page, they stated that 'WBV training . . . was not more efficient than [resistance] training'.

Verschueren and Co-Workers (2004) [10]

This study compared the effects of WBV and resistance training on bone mineral density (BMD), muscular strength and postural control. The study involved 70 postmenopausal women (aged 58 - 74). The subjects were randomly assigned to one of two experimental groups: One group did WBV and the other did resistance training. A third group served as a control and didn't participate in any training. The subjects in the experimental groups performed their assigned training three times per week for 24 weeks with at least one day of recovery between each session.

The subjects in the WBV group stood with one foot or both feet on a vibration platform. While standing on the platform, the subjects did five static and dynamic exercises: the squat, deep squat, wide-stance squat, one-legged squat and lunge. Over the course of 24 weeks, the volume was

increased systematically by increasing the duration of vibration in one session, the number of series of one exercise or the number of different exercises; the intensity was increased by shortening the recovery periods, increasing the amplitude and/or frequency of the vibration (from 35 to 40 Hz) or changing the manner in which the exercises were done (from two legs to one leg).

The subjects in the resistance-training group performed what's assumed to be total-body workouts that included the leg press and leg extension. (The researchers didn't specify that total-body workouts were done but it's likely since the program lasted for about one hour.) The load was increased from 20-RM to 15-RM to 12-RM to 10-RM to 8-RM in the first 14 weeks. They did two sets of each exercise. The load varied between three sets of 12-RM and one set of 8-RM in the last 10 weeks. The amount of recovery between each set wasn't specified.

WBV had a significant increase in isometric and dynamic strength of the quadriceps. However, there was no significant difference between those improvements and that produced by resistance training. The WBV group had a significant increase in BMD of the hips. This was significantly better than that produced by resistance training. There were no significant improvements made by either of the two experimental groups in total body BMD, lumbar spine BMD or lean-body mass. Both experimental groups had a significant decrease in fat mass but resistance training had a significantly greater decrease than WBV. Lastly, WBV had a significantly improved recovery in postural control in two of the four conditions that were measured. Resistance training produced no improvement in any of the four conditions.

Interestingly, the authors stated that 'vibration training is increasingly being promoted as a safe and efficient training method to improve muscular strength'. As the sole support for their assertion, they cited one reference: An earlier work by the three lead authors of this study.

Cochrane and Stannard (2005) [11]

This randomized, crossover study compared the acute effects of WBV and bicycle ergometry on vertical jump, grip strength and flexibility. The study involved 18 elite female field hockey players (average age 21.3). All subjects were assigned to perform vibration training and bicycle ergometry. The design of this study was such that the subjects also acted as their own controls, receiving sham vibration.

The subjects in the WBV group stood with one foot or both feet on a vibration platform. While standing on the platform, the subjects did six static and dynamic exercises/activities: standing in an erect position (knees semi-locked), squatting isometrically (knee angle about 120 degrees), kneeling on the ground with arms straight and hands on the platform, squatting dynamically (using a pace of two seconds up and two seconds down; depth of knee angle about 120 degrees), lunging with the left leg on the platform and the right leg on the ground and lunging with the right leg on the platform and the left leg on the ground. The experimental limbs were exposed to one minute of vibration in the first four exercises/activities and 30 seconds of vibration in the last two exercises/activities. The amount of recovery between each exposure wasn't specified. In effect, the experimental limbs received five minutes of vibration (at 26 Hz). The subjects also performed the same protocol on the platform without it vibrating. In addition, the subjects pedaled a stationary bicycle at 50 revolutions per minute for five minutes at 50 watts.

Within 15 seconds of completing the experimental condition, WBV produced significant improvements in vertical jump and flexibility (a sit-and-reach test). This performance was significantly better than that of bicycle ergometry. Neither WBV nor bicycle ergometry improved grip strength.

The improvements in vertical jump of 8.1% and flexibility of 8.2% by well-trained athletes immediately following five minutes of WBV is, in the words of the researchers, 'difficult to explain'. For some other researchers, such remarkable improvement might be equally difficult to believe.

A side note: It was troubling to see that the researchers of this study stated that WBV has been 'proven to be effective' in improving body composition and as support, noted the aforementioned research of Roelants and co-workers (2004). In that study, the subjects in the WBV group increased their fat-free mass (from 98.12 pounds to 100.32 pounds) but also increased their fat mass (from 39.60 pounds to 41.14 pounds), resulting in an *increase* in their percentage of body fat (from 28.3% to 28.6%). And even then, the increase in fat-free mass by the WBV group wasn't significantly better than that of the fitness and control groups.

Delecluse and Co-Workers (2005) [12]

In this study, researchers examined the effects of WBV on muscular strength, speed of movement, vertical jump, force-time characteristics of the start action of a sprint and sprint running velocity. The study involved 20 experienced sprint-trained athletes (seven women and 13 men; aged 17 - 30). The subjects were randomly assigned to one of two groups: One group did WBV and the other group served as a control. Over a five-week period, the subjects in both groups continued their usual training program (consisting of sprint training and resistance training) but the WBV group did an additional three sessions of vibration training per week. The vibration training was done prior to their usual training.

The subjects in the WBV group stood with one foot or both feet on a vibration platform. While standing on the platform, the subjects did six static and dynamic exercises: the high squat (knee angle 125 degrees, hip angle 140 degrees), deep squat (knee angle 90 degrees, hip angle 80 degrees), wide-stance squat, one-legged squat (knee angle 125 degrees, hip angle 140 degrees), lunge and calves (a high squat while standing on the toes). Over the course of five weeks, the volume was increased systematically by increasing the duration of vibration in one session (from nine minutes to 18 minutes); the intensity was increased by shortening the recovery periods (from one minute to five seconds) or increasing the amplitude and/or frequency of the vibration (from 35 to 40 Hz).

WBV didn't produce a significant increase in any measure that was tested. This includes isometric and dynamic strength of the quadriceps and hamstrings; speed of movement during a leg extension with 1%, 20%, 40% or 60% of isometric maximum; vertical jump; force-time characteristics of the start action of a sprint and sprint running velocity during a maximal run of 30 meters.

Cormie and Co-Workers (2006) [13]

This study investigated the acute effects of WBV on muscle activity, muscular strength and power. The study involved nine 'moderately resistance-trained' men (aged 19 - 23). All subjects were assigned to perform vibration training. The design of this study was such that the subjects also acted as their own controls, receiving sham vibration.

The subjects stood with both feet on a vibration platform while keeping their knees in a static position at an angle of 100 degrees. They were exposed to 30 seconds of vibration (at 30 Hz). The subjects also performed the same protocol on the platform without it vibrating.

Immediately after completing the experimental condition, WBV produced a significant improvement in the vertical jump. This was significantly better than that of sham vibration. But within 5, 15 and 30 minutes of completing the experimental condition, there were no significant differences between WBV and sham vibration in vertical jump. There were no significant differences between WBV and sham vibration in peak power during the vertical jump, peak force during an isometric squat or integrated electromyography of the quadriceps and hamstrings during the vertical jump and isometric squat.

Conclusions

Several of the studies that examined WBV have one or more design flaws that make it difficult or impossible to draw meaningful conclusions. In some studies, for example, the number of subjects was quite small. This makes it difficult to extrapolate the results to larger populations. In other studies, there was no control or comparison group. This makes it impossible to tell if an improvement was attributable to the exercises or the vibration.

With respect to acute (immediate) effects, WBV has been shown to increase vertical jump and flexibility. This doesn't appear to be a lasting or long-term effect, however, leading some to view WBV as a potential warm-up procedure rather than a recommended training protocol.

In most of the long-term studies (12 - 24 weeks) that did use one or more comparison groups, there were no significant differences between WBV and some other type of training – usually resistance training – in a variety of measures. This includes isometric and dynamic strength, vertical jump, speed of movement and fat-free mass. It's interesting to consider that this information can be interpreted two different ways: (1) WBV is no better than resistance training or (2) WBV produces the same results as resistance training. While both interpretations are true, it's the latter one that's used as a selling point to market WBV as an 'effective alternative' to conventional training.

It also is clear is that WBV has very low oxygen requirements. Thus, WBV will do little to improve aerobic fitness.

When administered for up to 24 weeks at 26 - 45 Hz, WBV appears to be safe with very few side effects reported. Nevertheless, the effects of long-term exposure to vibration are unknown. Jordan and co-workers (2005) [14] noted: 'The main factors that must be considered to ensure the safety of the athletes engaged in vibration training are the magnitude of vibration (frequency and amplitude), the duration of exposure, and the body position during the exposure'.

It's thought that long-term exposure can have negative physiological and anatomical effects. Specifically, there's a concern about damaging blood vessels, nerves and joints. Another possibility is blurry vision. These fears are heightened when considering that commercial devices may not accurately or adequately control the vibration amplitude and frequency.

Bottom line: WBV is a concept that appeals to individuals who seek an easy, short-term fix but there are no miracles here.

SUMMARY OF STUDIES THAT FOUND AT LEAST SOME SUPPORT FOR WHOLE-BODY VIBRATION (WBV)

Author and Year	Type of Study	Subjects	Results of Study
Bosco et al. (1998)	randomized 2 groups: 1. WBV 2. control	14 physically active students (gender unknown); age 20.2	WBV had significant increase in highest rise of center of gravity, maximal mechanical power and average height during continuous jumping for 5 seconds; no significant increase in average mechanical power during continuous jumping for 5 seconds
Bosco et al. (1998)	randomized 2 groups: 1. WBV (one leg) 2. control (other leg)	6 elite volleyball players (all women); age 19.5	Acute effects of WBV showed significant increase in average velocity, force and power during dynamic leg press with 154, 198, 242 and 286 pounds (with exception of slight increase in average force with 154 pounds)
Delecluse et al. (2003)	randomized 4 groups: 1. WBV 2. sham vibration 3. resistance training 4. control	67 untrained women; age 21.4	WBV and resistance training had significant increases in isometric and dynamic strength; no significant difference between groups; WBV had significant increase in vertical jump; neither WBV or resistance training had significant increase in ballistic strength; placebo (sham vibration) and control had no significant increase in any measure
de Ruiter et al. (2003b)	no randomization 2 groups: 1. WBV 2. control	20 healthy students (8 women + 12 men); age 20.3	WBV produced significant increase in stimulated maximal rate of isometric force rise; WBV produced no increase in isometric muscle force, voluntary action or maximal rate of voluntary force rise or vertical jump more than the control
Verschueren et al. (2004)	randomized 3 groups: 1. WBV 2. resistance training 3. control	48 postmenopausal women; age 58-74	WBV produced significant increase in isometric and dynamic strength; no significant difference between those improvements made by WBV and that of resistance training; WBV produced significant increase in BMD of hips which was significantly better than that produced by resistance training; no significant increase made by WBV or resistance training in total body BMD, lumbar spine BMD or LMB; WBV and resistance training had significant decrease in fat mass but resistance training had significantly greater decrease; WBV had significant improvement of postural control in 2 of 4 conditions; resistance training had no improvement in any condition
Cochrane et al. (2005)	randomized, cross-over; all subjects assigned to WBV and bicycle ergometry	6 elite field hockey players (all women); age 21.3	Acute effects of WBV showed significant increases in vertical jump and flexibility; this was significantly better than that of bicycle ergometry; neither WBV nor bicycle ergometry improved grip strength
Cormie et al. (2006)	no randomization, crossover; control treatment received sham vibration	9 "moderately resistance-trained" men; age 19-23	Acute effects of WBV showed significant increase in vertical jump; this was significantly better than sham vibration; within 5, 15 and 30 minutes of completing treatment, no significant differences between WBV and sham vibration in vertical jump; no significant differences between WBV and sham vibration in peak power during the vertical jump, peak force during an isometric squat or integrated electromyography of the quadriceps and hamstrings during the vertical jump and isometric squat

SUMMARY OF STUDIES THAT FOUND LITTLE OR NO SUPPORT FOR WHOLE-BODY VIBRATION (WBV)

Author and Year	Type of Study	Subjects	Results of Study
Rittweger et al. (2000)	all subjects assigned to WBV and bicycle ergometry	37 healthy subjects (16 women + 21 men); age 23.5	Acute effects of WBV showed lower heart rate and oxygen intake compared to bicycle ergometry
Torvinen et al. (2002)	randomized, crossover; control treatment received sham vibration	16 healthy subjects (8 women + 8 men); age 18-35	Acute effects of WBV showed no significant increase in maximal isometric strength, vertical jump, grip strength, stability/balance, dynamic balance or agility
de Ruiter et al. (2003a)	no control group	12 untrained subjects (5 women + 7 men); age 23.3	Acute effects of WBV showed significant decline in voluntary activation of quadriceps; five additional sessions of WBV produced no increase in muscle activation during maximal isometric force production and maximal rate of isometric force rise
Roelants et al. (2004a)	no randomization 3 groups: 1. WBV 2. fitness training 3. control	48 untrained women; age 21.3	WBV had significant increase in fat-free-mass; no significant difference between groups; WBV had increase in fat mass and percentage of body fat; fitness training and control had decrease in percentage of body fat; no significant difference between WBV and fitness training in increase in strength at any velocity tested
Roelants et al. (2004b)	randomized 3 groups: 1. WBV 2. resistance training 3. control	89 postmenopausal women; age 58-74	WBV produced significant increase in isometric and dynamic strength, speed of movement with 1% and 20% of isometric maximum (but not with 40% or 60% isometric maximum) and vertical jump; no significant difference between any improvements made by WBV and that of resistance training
Delecluse et al. (2005)	randomized 2 groups: 1. WBV 2. control	20 sprint-trained athletes (7 women + 13 men); age 17-30)	WBV had no significant increase in any measure tested; this includes isometric and dynamic strength; speed of movement with 1%, 20%, 40% or 60% of isometric maximum; vertical jump; force-time characteristics of the start action of a sprint and sprint running velocity

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Science Department

Do You Need to Perform Vigorous Aerobic Exercise for Your Health?

Swain DP, Franklin BA. Comparison of cardiorespiratory benefits of vigorous versus moderate intensity aerobic exercise. *American Journal of Cardiology.* 2006; *97*: 141-147.

Health behavior data show that only a small minority of people in developed countries is consistently physically active to meet minimal health guidelines of engaging in 30 minutes of moderate intensity activity most days of the week or engaging in vigorous physical activity for 20 minutes for three days per week. Studies, however, indicate that many people report not liking to perform vigorous physical. Because there are some benefits for engaging in lower to moderate intensity physical activity and given the reports that people find vigorous physical activity aversive, public health programs have emphasized promoting moderate physical activity. An example of moderate physical activity is brisk walking defined as walking at about a 3.5 to 4.0 mile per hour (mph) pace.

Regular walking can help in preventing weight gain and has, as noted, some positive effects on other mechanisms associated with health.

The seminal research on physical activity and health benefits though had a somewhat different focus than reflected in today's public health programs. The earlier epidemiological research focused on how engagement either through occupation or recreation in different levels of work affected morbidity (usually heart disease and stroke) and mortality (premature death). Work was converted to estimated METs, a measure of oxygen consumption. One MET is the equivalent of oxygen consumption at rest. Brisk walking on a flat surface is equivalent to about four METs. Jogging a 12-minute mile on a flat surface is the equivalent of about 8 METs. Walking up steep hills requires much more oxygen consumption than walking on a flat surface. For example, walking at 4 mph up a 10% grade is about 10 METs.

This earlier research generally showed that people who regularly performed work at a higher MET level had lower risk for heart disease and stroke and for premature mortality.

Later research supported these initial findings. Men and women were assessed for their actual fitness (aerobic capacity) in a lab using standard protocols. They were then followed up for 10-20 years later. People who had a higher aerobic capacity (the ability to use oxygen) had decreased