

SPORLASTIC SPORTS & HEALTH

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Ganzkörpervibrationstraining
Ausgewählte Untersuchungen



↳ Whole-body vibration and rehabilitation of chronic diseases: A review of the literature

Chanou K, Gerodimos V, Karatrantou K, Jamurtas A
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The objectives of the study were to review the current literature and findings on the effects of whole-body vibration (WBV) as a training method on performance and its ability to aid in the rehabilitation of chronic diseases (neurological, musculoskeletal or metabolic conditions). Six electronic databases were searched. The combination of the search terminology used included WBV and several neurological, musculoskeletal and metabolic conditions. Twenty six papers were found to be relevant for this review and were included for critical evaluation with regards to sample characteristics, research intervention and methodology. Most studies were conducted on patients diagnosed with neurological conditions (n = 15) while less were performed on patients suffering from musculoskeletal (n = 7) or metabolic (n = 4) disorders. Comparisons were difficult to draw on because of the different pathologies and the differences in the methodology of each study. Some of the observed methodological flaws included limitations in relation to insufficient randomisation, lack of sample homogeneity (size, age variability) and poor blinding in most studies. No consensus could be reached as to whether WBV is more effective than other interventions or no intervention at all, while the additional effects that WBV may have in relation to other interventions could not be assumed. **Nevertheless, chronic WBV training seems to only improve strength in neurological patients while balance and mobility improves only in patients suffering from musculoskeletal or metabolic but not from neurological conditions. Although WBV did not prove to be more effective compared to other training methods, it can be used, in some cases, as a less fatiguing and less time-consuming method to enhance physical capabilities. Future research should focus on the effectiveness of WBV in relation to no treatment at all, and to age.**

N A comparison of the effect of two types of vibration exercise on the endocrine and musculoskeletal system

Elmantaser M, McMillan M, Smith K, Khanna S, Chantler D, Panarelli M, Ahmed SF
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Background: Whole body vibration (WBV) is a novel training intervention but a comparison of different methods of WBV has rarely been performed.

Aim: To compare the short and medium term effects of two regimens of WBV on endocrine status, muscle function and markers of bone turnover.

Patients and Methods: Over a period of 16 weeks, 10 men with a median age of 33 yrs (range, 29, 49), were randomized to stand on the Galileo platform (GP) or Juvent1000 platform (JP) 3 times/wk. The total study duration was 16 weeks with measurements performed in a 4 week period of run-in, 8 weeks of WBV and a 4 week period of washout. These measurements included an assessment of anthropometry, body composition, muscle function and biochemical markers of endocrine status and bone turnover. To assess immediate effects of WBV, measurements were also performed at 60 mins before and 5, 30 and 60 mins after WBV. To assess immediate effects of WBV, measurements were also performed at 60 mins before and 5, 30 and 60 mins after WBV.

Results: GP at 22 Hz was associated with an immediate increase in serum GH, rising from 0.07 µg/l (0.04,0.69) to 0.52 µg/l (0.06,2.4) ($p=0.06$), 0.63 µg/l (0.1,1.18) ($p=0.03$), 0.21 µg/l (0.07,0.65) ($p=0.2$) at 5 mins, 20 mins and 60 mins after WBV, respectively. An immediate effect was also observed in median serum cortisol which reduced from 316 nmol/l (247,442) before WBV to 173 nmol/l (123,245) ($p=0.01$), 165 nmol/l (139,276) ($p=0.02$) and 198 nmol/l (106,294) ($p=0.04$) at 5 mins, 20 mins and 60 mins after WBV, respectively. Median serum CTX reduced significantly after 8 weeks of WBV training in the GP group from 0.42 ng/ml (0.29,0.90) pre-WBV to 0.29 ng/ml (0.18,0.44) at the end of WBV training ($p=0.03$). Over the 8 weeks, there was a reduction in median serum cortisol in the GP group from 333 nmol/l (242,445) (pre-WBV) to 270 nmol/l (115,323) WBV ($p=0.04$). None of the changes observed in the JP group reached statistical significance. Neither group showed any significant effect on muscle function, IGF-1, testosterone, leptin, CRP, creatine kinase, insulin or other markers of bone turnover.

Conclusion: WBV can stimulate GH secretion, reduce circulating cortisol and reduce bone resorption. These effects are independent of clear changes in muscle function and depend on the type of WBV that is administered.

W Whole body vibration exercise improves body balance and walking velocity in postmenopausal osteoporotic women treated with alendronate: Galileo and Alendronate Intervention Trail (GAIT)

Iwamoto J, Sato Y, Takeda T, Matsumoto H

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A randomized controlled trial was conducted to determine the effect of 6 months of whole body vibration (WBV) exercise on physical function in postmenopausal osteoporotic women treated with alendronate. Fifty-two ambulatory postmenopausal women with osteoporosis (mean age: 74.2 years, range: 51–91 years) were randomly divided into two groups: an exercise group and a control group. A four-minute WBV exercise was performed two days per week only in the exercise group. No exercise was performed in the control group. All the women were treated with alendronate. After 6 months of the WBV exercise, the indices for flexibility, body balance, and walking velocity were significantly improved in the exercise group compared with the control group. The exercise was safe and well tolerated. The reductions in serum alkaline phosphatase and urinary cross-linked N-terminal telopeptides of type I collagen during the 6-month period were comparable between the two groups. **The present study showed the benefit and safety of WBV exercise for improving physical function in postmenopausal osteoporotic women treated with alendronate.**

Sarkopenie und Vibrationstraining –Eine Übersicht

Kaeding TS

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Der Verlust von Muskelmasse, muskulärer Kraft und muskulärer Ausdauerleistungsfähigkeit im Altersgang wird unter der Bezeichnung „Sarkopenie“ zusammengefasst. Dieses Phänomen ist in der älteren Bevölkerung weit verbreitet und bedeutet eine große finanzielle Belastung für das Gesundheitssystem. In Folge der Sarkopenie treten funktionale und metabolische Konsequenzen auf, die unter anderem in Verbindung mit einem Verlust der selbstständigen Lebensführung und der Erkrankung an verschiedenen chronischen Erkrankungen gebracht werden. **Eine Intervention mit einem Vibrationstraining scheint in der Lage zu sein, vor allem bei älteren Menschen mit einem niedrigen Ausgangsniveau, die Muskelkraft signifikant und in ähnlichem Umfang wie ein klassisches Krafttraining zu steigern. Eine Kraftsteigerung wird dabei hauptsächlich durch eine verbesserte inter- und intramuskuläre Koordination sowie möglicherweise auch durch eine Muskelhypertrophie erreicht. Ein geringes Verletzungsrisiko und das nur seltene Auftreten von Nebenwirkungen machen das Vibrationstraining zu einer interessanten Alternative für ältere Menschen.**

The effect of whole body vibration on balance, mobility and falls in older adults: A systematic review and meta-analysis

Lam FMH, Lau RWK, Chung RCK, Pang MYC
published in Maturitas 2012; 72: 206- 213

This systematic review aimed to examine the effect of WBV on balance, mobility and falls among older adults. The databases used included MEDLINE, the Excerpta Medica database, the Cumulative Index to Nursing and Allied Health Literature, the Cochrane Library Databases of Systematic Reviews, Physiotherapy Evidence Database (PEDro), PubMed, and Science Citation Index (last search in October 2011). Randomized controlled trials that investigated the effect of WBV on balance, mobility or falls in older adults were included in this review. The PEDro score was used to examine the methodological quality of the selected studies. The effect of WBV on balance, mobility and fall-related outcomes were extracted. The data extraction and rating were performed by a researcher and the results were confirmed by the principal investigator. Meta-analysis was done if 3 or more studies measured the same outcome of interest. Among 920 articles screened, fifteen articles (thirteen trials) satisfied the criteria and were included in this review. Methodological quality was good for six of the studies (PEDro score = 6-7). Meta-analysis revealed that WBV has a significant treatment effect in Tinetti Total Score ($p < 0.001$), Tinetti Body Balance Score ($p = 0.010$) and Timed-Up-and-Go test ($p = 0.004$). No significant improvement was noted in Tinetti Gait Score after WBV training ($p = 0.120$). The effect of WBV on other balance/mobility outcomes and fall rate remains inconclusive. **To conclude, WBV may be effective in improving relatively basic balance ability and mobility among older adults, particularly frailer ones. More good-quality WBV trials are required.**

The effects of whole-body vibration on muscle strength and power: A meta-analysis

Osawa Y, Oguma Y, Ishii N

published in Journal of Musculoskeletal and Neuronal Interactions 2013; 13(3):380-390

Exercise with whole-body vibration (WBV) is becoming popular as an alternative to conventional training or as supplementary training. However, despite increasing research efforts in this field, additive effects of WBV on muscle performance remain unclarified. In this review, we investigated the additive effects of long-term WBV on muscle strength and power. This meta-analysis was restricted to randomized controlled trials lasting for at least 5 weeks comparing exercise with and without WBV, or comparing only WBV exposure and control. Data from a total of 314 participants in 10 studies on knee extension muscle strength, and 249 participants in 7 studies on countermovement jump height were pooled using random-effect models. Meta-analysis showed significant additional effects of WBV on muscle strength (standardized mean difference [SMD]=0.76, 95% confidence interval [CI]=0.21-1.32; $p=0.007$) and countermovement jump (SMD=0.87, 95% CI=0.29-1.46; $p=0.003$). **Based on these findings, we concluded that the use of WBV would lead to greater improvements in both knee extension muscle strength and countermovement jump than under identical conditions without WBV.**

↳ Vibration as an exercise modality: how it may work, and what its potential might be

Rittweger J

published in European Journal of Applied Physiology 2010; 108: 877-904

Whilst exposure to vibration is traditionally regarded as perilous, recent research has focussed on potential benefits. Here, the physical principles of forced oscillations are discussed in relation to vibration as an exercise modality. Acute physiological responses to isolated tendon and muscle vibration and to whole body vibration exercise are reviewed, as well as the training effects upon the musculature, bone mineral density and posture. Possible applications in sports and medicine are discussed. **Evidence suggests that acute vibration exercise seems to elicit a specific warm-up effect, and that vibration training seems to improve muscle power, although the potential benefits over traditional forms of resistive exercise are still unclear. Vibration training also seems to improve balance in sub-populations prone to fall, such as frail elderly people. Moreover, literature suggests that vibration is beneficial to reduce chronic lower back pain and other types of pain. Other future indications are perceivable.**

∞ Effects of whole-body vibration on postural control in elderly: A systematic review and metaanalysis

Rogan S, Hilfiker R, Herren K, Radlinger L, D Bruin ED
published in BMC Geriatrics 2011; 11:72

Background: This systematic review was performed to summarize the current evidence for whole body vibration (WBV) interventions on postural control in elderly.

Methods: English and German language papers in Medline, PEDro, Cinahl and the Cochrane databases were searched. Two reviewers extracted data on patients' characteristics, type of WBV intervention and outcomes. Two independent reviewers rated the methodological quality of these studies. Data were pooled using random-effects meta-analysis.

Results: Fifteen papers reporting quantitative data were included. Results from 15 papers could be pooled for a meta-analysis. The studies involved 933 participants. In 7 studies the authors investigated the effects of vibration plates generating vertical sinusoidal vibrations (VS-WBV) and 7 papers described the use of side-alternating sinusoidal vibrations (SS-WBV). One study investigated both VS-WBV and SS-WBV. Weak to moderate evidence of an overall effect as a result of VS-WBV and SS-WBV was observed for (a) static balance for post-intervention values with a standardized mean difference (SMD) -0.06, 95% CI -0.31 to 0.18 and for change values SMD -0.26, 95% CI -1.09 to 0.57, and (b) dynamic balance for post-intervention-values SMD -0.34, 95% CI -0.60 to -0.08. For functional balance (c) an overall outcome for post-intervention values with SMD of 0.34, 95% CI -0.19 to 0.87 was found.

Conclusions: The 15 studies reviewed were of moderate methodological quality. In summary, SS-WBV seems to have a beneficial effect on dynamic balance in elderly individuals. However, the current results should be interpreted with caution because of the observed heterogeneity of training parameters and statistical methods. Future studies are warranted to evaluate the effects of WBV on postural control in an elderly population.

Effect of whole-body vibration on BMD: A systematic review and meta-analysis

Slatkovska L, Alibhai SMH, Beyene J, Cheung AM
published in Osteoporosis International 2010; 21: 1969-1980

Our systematic review and meta-analysis of randomized controlled trials (RCTs) examining wholebody vibration (WBV) effect on bone mineral density (BMD) found significant but small improvements in hip areal BMD (aBMD) in postmenopausal women and in tibia and spine volumetric BMD in children/adolescents, but not in other BMD measurements in postmenopausal women and young adults.

Introduction: Animal experiments report anabolic bone changes in response to WBV, but data in humans are limited. Our objective is to conduct a systematic review and meta-analysis of RCTs examining WBV effect on BMD.

Methods: Eligible RCTs included randomized or quasi randomized trials, with follow-up of ≥ 6 months, examining WBV effects on BMD in ambulatory individuals without secondary causes of osteoporosis. The weighted mean differences between WBV and control groups in absolute pre-post change in spine and hip aBMD, and in spine and tibia trabecular volumetric BMD (vBMD) were calculated. **Results:** Eight RCTs in postmenopausal women (five RCTs), young adults (one RCT), and children and adolescents (two RCTs) were included. The regimens were heterogeneous, study durations were relatively short, and available data was mostly per-protocol. In postmenopausal women, WBV was found to significantly increase hip aBMD (0.015 g cm^{-2} ; 95% confidence interval (CI), 0.008-0.022; $n=131$) versus controls, but not spine aBMD ($n=181$) or tibia trabecular vBMD ($n=29$). In young adults, WBV did not increase spine or hip bone mineral content, or tibia trabecular vBMD ($n=53$). In children and adolescents, WBV significantly increased spine (6.2 mg cm^{-3} ; 95% CI, 2.5-10.0; $n=65$) and tibia (14.2 mg cm^{-3} ; 95% CI, 5.2-23.2; $n=17$) trabecular vBMD.

Conclusions: We found significant but small improvements in BMD in postmenopausal women and children and adolescents, but not in young adults. WBV is a promising new modality, but before recommendations can be made for clinical practice, large-scale long-term studies are needed to determine optimal magnitude, frequency, and duration.