Austin Sports Medicine

Open Access

Austin Publishing Group

Mini Review

Whole-Body Vibration Training in Workplace-Health Promotion: A Promising Intervention?

Kaeding TS*

Institute of Sports Science, Carl Von Ossietzky University of Oldenburg, Germany

***Corresponding author:** Kaeding TS, Institute of Sports Science, Carl Von Ossietzky University of Oldenburg, Germany

Received: September 22, 2017; **Accepted:** October 06, 2017; **Published:** October 13, 2017

Abstract

Introduction: Whole-body vibration training is more and more subject of scientific research and frequently used in practice. It is considered to be effective and well-suited for older people and a safe and effective preventive intervention for unfit people. The purpose of this review is to figure out the scientific evidence for the use of such interventions in workplace-health promotion.

Current State of Research: To date, four studies show an effectiveness and safety of interventions with whole-body vibration training using sinus like and random vibrations in healthy white and blue-collar employees as well as in employees with back pain.

Discussion: Considering that advantages of whole-body vibration training like its high simulative nature, being less time consuming and subjectively less exhausting than other methods of exercise, the results of the first studies on the use of whole-body vibration training in workplace-health promotion are promising. With respect to the different training parameters and modes of vibration used in the studies it is obvious, that the optimal training parameters and their combination should be studied further, perhaps combined with aerobic exercise as a potential part of future multidisciplinary interventions in workplace-health promotion.

Conclusion: Even though the negative effects of occupational whole-body vibration exposure are well documented, whole-body vibration training seems to be an effective, safe and suitable preventive workplace-based intervention for white and blue-collar employees. Therefore, whole-body vibration training seems to be a promising stand-alone preventive intervention in workplace-health promotion or part of multimodal preventive workplace-based interventions.

Keywords: Vibration Training; Exercise; Workplace; Health Promotion; Employee

Abbreviations

WBV: Whole-Body Vibration; WBVT: Whole-Body Vibration Training; LBP: Low-Back Pain; CLBP: Chronic Low-Back Pain; INT: Intervention Group; CON: Control Group; Hz: Hertz; RMQ: Roland and Morris Disability Questionnaire; ODI: Oswestry Disability Index; WAI: Work-Ability-Index Questionnaire

Introduction

The workplace is considered a particularly suitable place for the introduction of health-orientated physical activity interventions to employees [1]. There is strong evidence that multidisciplinary interventions improve function, moderate evidence for the reduction of pain and contradictory evidence regarding occupational outcomes [2]. Exercise is usually part of such multidisciplinary interventions, even in the occupational field. Physical activity seems to be a keystone in early intervention and is usually recommended for employees [3].

The motivation of participating employees and associated with it, the adherence, is a key factor for the long-term success of a movement-related intervention [3]. In most cases the majority of subjects fail to continue an exercise program after the initial phase ends, which can negatively affect the maintenance of the effects of the intervention over time [4]. Short exercise sessions seem to be important for reaching high levels of adherence and are preferred by employees and employers. Such so-called "short and sharp" interventions are preferred because they most likely do not decrease work productivity [3]. Moreover, the prescribing of exercise to employees at their place of work improves their adherence to exercise interventions. Usually, a compliance of approximately 76% can be expected [3].

Methods of Whole Body Vibration Training (WBVT) have become an increasingly popular subject of scientific research and are used frequently in practice in mass sport and particularly in the context of therapeutically measures [5,6]. The intensity of WBVT is mainly regulated by the duration of each training session as well as each set, the frequency, the amplitude and the body position, respectively exercises performed on the device [5].

WBVT is considered to be effective and well-suited for older patients and is considered a minimal preventive intervention for unfit people [7,8]. Widely-used are devices which are working with sinus like and relatively high-frequency vibration stimuli. The second vibration mode, which is more and more used in the field of medical and therapeutically treatment, is random WBV [9].

Citation: Kaeding TS. Whole-Body Vibration Training in Workplace-Health Promotion: A Promising Intervention?. Austin Sports Med. 2017; 2(2): 1018.

WBVT is considered to be effective and well-suited for older people and generally is considered a minimal preventive intervention for unfit people [7,8]. The high simulative nature, as well as other advantages of WBVT, includes being less time consuming and subjectively less exhausting than typical methods of exercise, generally result in a high compliance with WBVT [7]. This aspect is of outmost importance because generating long-term interest and motivation in participating employees is a great challenge in health-orientated physical activity interventions in the workplace [10]. Approximately one third of a company's work force is interested in participating in such programs. However, almost half of the participating employees end their participation within the first months [10]. From an organizational perspective, devices for WBVT are applicable in the occupational setting because they only need 2-4 square meters and are easy to use and safe when respecting basic principles for the use of such devices. Therefore, WBVT can be done by employees autonomously after an informed introduction which means that fewer personnel are needed.

The negative effects of occupational Whole-Body Vibration (WBV) exposure are well documented. There is scientific evidence that the exposure to occupational WBV increases the risk of low-back pain [11]. Such vibrations differ basically from vibrations used in WBV training regarding duration, frequency and amplitude. The occupational exposition to WBV as well as the frequency and the amplitude most often are considerably higher compared to WBVT [12,13]. Besides an employee is most often exposed to WBV passively, whereas an exercising person uses activated musculature to dampen the applied vibrations [13]. The purpose of this narrative review is to figure out the scientific evidence for the use of WBVT in workplace-health promotion.

Current State of Research

Sinus like vibrations

To date, only one study is published examining whether WBVT using sinus like stimuli is able to reduce back pain and physical disability in seated working office employees with chronic low-back pain [14]. In this study 41 subjects (68.3% female) were randomly allocated to an intervention group (INT (n= 21)) or a control group (CON (n=20). Participants were male and female office employees suffering from chronic low-back pain. While the subjects of the CON did not participate in an intervention, those of the INT participated in an unsupervised WBVT 2.5 times each week for three months. Each training session lasted approximately 15 minutes and consisted of five sets of a duration of 60-120 seconds, a frequency of 10-30 Hz and amplitude of 1.5-3.5 millimeters based on a specific training program. The subjects of the intervention group were instructed to use a basic position on the device (feet parallel to each other depending on the selected amplitude, legs slightly bent, holding a slightly lordotic back, abdominal muscles contracted, hands on the hand rails, and head held erect). The subjects did not carry out any other dynamic or static exercise on the device [14]. The primary outcome was the change in the Roland and Morris disability questionnaire (RMQ) score over the study period. In addition, secondary outcomes included changes in the Oswestry Disability Index (ODI), the Work-Ability-Index Questionnaire (WAI), the quality of life questionnaire SF-36, the Freiburger activity questionnaire and an isokinetic test of the musculature of the trunk. The compliance with the intervention in the INT reached a mean of 81.1% and no long-lasting unwanted side effects were detected. Significant positive effects of three months of WBVT in the INT compared to the CON regarding the RMQ ($p=0.027$), the ODI ($p=0.002$), the SF-36 ($p=0.013$), the Freiburger activity questionnaire ($p=0.022$), the post-interventional sick leave in the INT ($p=0.008$) and trends regarding a positive effect of the intervention on the muscular capacity of the muscles of the trunk in flexion were detected [14].

Random vibrations

Three studies investigated the use of a supervised WBVT using random WBV in a workplace setting with white and blue-collar employees [15-17].

Elfering et al. implemented WBVT using random WBV to improve postural control of 124employees (86% female) of a university hospital with or without current low back pain with respect to tumbling, slipping, and (near-)falls [15]. The subjects were randomly assigned to an experimental group (n= 68) engaged in the intervention for eight weeks with three training sessions each week and a CON (n= 56) with no intervention. Most of the subjects were nursing staff (41%). The subjects of the INT were instructed to stand on the device with their arms hanging loose at their sides and knees slightly bent. At the start, they were asked to use a vibration frequency of 3Hz but further were allowed to change the frequency in order to feel most comfortable. The amplitude was fixed at 3 millimeters. Each training session consisted of at least three sets, each lasting one minute with a one-minute break between the sets [15]. Postural control was assessed as mediolateral sway on a force plate before and after the intervention in both groups. No long lasting and unwanted side effects of the intervention were detected. WBVT using random WBV had a significantly positive effect on the mediolateral sway, assuming an improved postural control, in INT in comparison to the CON ($p=0.003$) [15]. It has to be pointed out, that only 58% of the subjects of the INT and 48% of the subjects of the CON completed the study. The compliance with the intervention was collected by asking the subjects of the INT on keeping their training schedule. Elfering et al. report, that 75% of the subjects of the INT who completed the study said they kept to their training schedule "almost always" or "rather often" [15].

One year before, Elfering et al. published a study using a controlled crossover design comprising two groups each given four weeks of supervised WBVT using random WBV three times each week and no intervention during a second four week period [16]. 54 healthy, white-collar employees (85.2% male), participated in the study and outcomes were daily musculoskeletal well-being, musculoskeletal pain, and surefootedness collected with a questionnaire, as well as a behavioral test on body balance before and after the four weeks of intervention. The subjects were instructed to stand on the device with their arms hanging loose to the side and slightly bent knees. The frequency in each 60-second session started with 5Hz, and further the subjects were allowed to choose the frequency within a range of 4Hz to 8Hz at their own discretion. The amplitude was fixed at 3 millimeters. Each training session consisted of three sets, lasting one minute each, with a one minute break between the sets [16]. During the four week training period, musculoskeletal well-being and

surefootedness were significantly increased ($p<0.05$). Musculoskeletal pain was significantly reduced only in those subjects who reported low back pain during the last four weeks prior to the study ($p<0.05$). Body balance was significantly increased by the intervention as well ($p<0.05$).

These results are supported by those of a study by Burger et al. examining the effects of WBVT using random WBV for the prevention and treatment of work-related musculoskeletal symptoms and accidents in 38 white and blue-collar employees [17].

Discussion

Considering that WBVT seems to be a safe, effective and well-suited minimal preventive intervention for unfit people and taking into account its high simulative nature, being less time consuming and subjectively less exhausting than other methods of exercise, the results of the first studies on the use of WBVT in workplace-health promotion are promising [7,8]. These studies show the effectiveness and safety of interventions with WBVT using sinus like and random vibrations in healthy white and blue-collar employees as well as in employees with back pain. The used interventions had significant positive effects on the self-reported physical disability in employees with chronic low-back pain, aspects of their health related quality of life and post-interventional sick leave as well as a positive effect (trend) on the muscular capacity of the muscles of the trunk in flexion [14]. Also, such interventions had significant positive effects on the postural control and self-reported surefootedness in white and blue-collar workers, which is important with respect to tumbling, slipping, and (near-) falls at the workplace [15-17]. Aside, significant positive effects were seen on musculoskeletal well-being and musculoskeletal pain [15-17].

To date, only Kaeding et al. chose an unsupervised intervention with WBVT which also resulted in a safe and effective intervention for employees with chronic low-back pain reaching a high compliance (81.1%) with the intervention over three months [14]. This underlines the assumption that WBVT can be done autonomously after an informed introduction and therefore potentially requires fewer personnel compared to other movement related interventions. This contributes to a possible cost-effectiveness of such interventions. Interestingly, in the study of Elfering et al. only 58% of the subjects of the INT and 48% of the subjects of the CON completed the study for multiple reasons [15]. 17 subjects dropped out of the INT because they did not complete the intervention, but the compliance with the training schedule was high in those who completed it [15].

As mentioned before, the motivation of participating employees is a key factor for the long-term success of movement-related interventions [3]. Short exercise sessions seem to be important for reaching high levels of adherence and are preferred by employees as well as employers [3]. In all studies on the topic the intervention needed a maximum of 15 minutes including breaks and the employees did not have to change clothes, complete a warm-up or cool down, or take a shower after exercising [14]. However, WBV training might be more effective as a preventive intervention combined with aerobic exercise.

With respect to the different training parameters and modes of vibration used in the studies it is obvious, that the optimal training parameters and their combination for the use of WBV training as a preventive workplace-based intervention should be studied further, perhaps combined with aerobic exercise as a potential part of future multidisciplinary interventions in workplace-health promotion.

Conclusion

In conclusion, even though the negative effects of occupational WBV exposure are well documented, WBVT seems to be an effective, safe and suitable preventive workplace-based intervention for white and blue-collar employees. It requires barely any infrastructure, time and investment of participating employees. The intervention does not seem to interfere with usual work routines, even in settings with shift work. Therefore, WBVT seems to be a promising stand-alone preventive intervention in workplace-health promotion or part of multimodal preventive workplace-based interventions. Even though, the optimal training parameters and maybe their optimal combination for the use of WBVT as a preventive workplace-based intervention have to be studied further.

References

1. Shephard RJ. Worksite Fitness and Exercise Programs: A Review of Methodology and Health Impact. Am J Health Promot. 1996; 10: 436-452.
2. Guzmán J, Esmail R, Karjalainen K, Malmivaara A, Irvin E, Bombardier C. Multidisciplinary rehabilitation for chronic low back pain: systematic review. BMJ. 2001; 322: 1511-1516.
3. Bell JA, Burnett A. Exercise for the primary, secondary and tertiary prevention of low back pain in the workplace: a systematic review. J Occup Rehabil. 2009; 19: 8-24.
4. Linton SJ, Hellsing A-L, Bergström G. Exercise for Workers with Musculoskeletal Pain: Does Enhancing Compliance Decrease Pain? J Occup Rehabil. 1996; 6: 177-190.
5. Dolny DG, Reyes FC. Whole body vibration exercise: Training and benefits. Curr Sports Med Rep. 2008; 7: 152-157.
6. Jordan MJ, Norris SR, Smith DJ, Herzog W. Vibration Training: An overview of the Area, training consequences, and future considerations. J Strength Cond Res. 2005; 19: 459-466.
7. Marin PJ, Rhea MR. Effects of vibration training on muscle power: A Meta-Analysis. J Strength Cond Res. 2010; 24: 871-878.
8. Marin PJ, Rhea MR. Effects of vibration training on muscle strength: A Meta-Analysis. J Strength Cond Res. 2010; 24: 548-556.
9. Haas CT, Turbanski S, Kessler K, Schmidtbleicher D. The effects of random whole-body-vibration on motor symptoms in Parkinson's disease. Neuro Rehabilitation. 2006; 21: 29-36.
10. Shephard RJ. Do work-site exercise and health programs work? Phys Sportsmed. 1999; 27: 48-72.
11. Burström L, Nilsson T, Wahlström J. Whole-body vibration and the risk of low back pain and sciatica: a systematic review and meta-analysis. Int Arch Occup Environ Health. 2015; 88: 403-418.
12. Friesenbichler B, Lienhard K, Vienneau J, Nigg BM. Vibration transmission to lower extremity soft tissues during whole-body vibration. J Biomech. 2014; 47: 2858-2862.
13. Crewther B, Cronin J, Keogh J. Gravitational forces and whole body vibration: implications for prescription of vibratory stimulation. Phys Ther Sport. 2004; 5: 37-43.
14. Kaeding TS, Karch A, Schwarz R, Flor T, Wittke T-C, Kück M, et al. Whole body vibration training as workplace basedsports activity for employees with chronic back disorders. Scand J Med Sci Sports. 2017.
15. Elfering A, Schade V, Stoecklin L, Baur S, Burger C, Radlinger L. Stochastic resonance whole-body vibration improves postural control in health care

professionals: a worksite randomized controlled trial. Workplace Health Saf. 2014; 62: 187-196.

16. Elfering A, Arnold S, Schade V, Burger C, Radlinger L. Stochastic resonance whole-body vibration, musculoskeletal symptoms, and body balance: a worksite training study. Saf Health Work. 2013; 4: 149-155.

17. Burger C, Schade V, Lindner C, Radlinger L, Elfering A. Stochastic resonance training reduces musculoskeletal symptoms in metal manufacturing workers: a controlled preventive intervention study. Work. 2012: 42: 269-278.

Citation: Kaeding TS. Whole-Body Vibration Training in Workplace-Health Promotion: A Promising Intervention?. Austin Sports Med. 2017; 2(2): 1018.