Effects of whole-body vibration with stochastic resonance on balance in persons with balance disability and falls history – a systematic review
Slavko Rogan\textsuperscript{1,2}, Roger Hilfiker\textsuperscript{3}, Adrian Schenk\textsuperscript{1}, Aldo Vogler\textsuperscript{1}, Jan Taeymans\textsuperscript{1,4}

\textsuperscript{1}Bern University of Applied Sciences, Department of Health, Bern, Switzerland
\textsuperscript{2}Akademie für integrative Physiotherapie und Trainingslehre, Grenzach-Wyhlen, Germany
\textsuperscript{3}HES-SO Valais, University of Applied Sciences Western Switzerland, Sion, Switzerland
\textsuperscript{4}Faculty of Physical Education and Physiotherapy, Vrije Universiteit Brussel, Brussels, Belgium

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1. Background

Two kinds of whole-body vibration devices exist: sinusoidal and stochastic resonance whole-body vibration (1). Stochastic resonance is commonly understood as the enhancement of a nonlinear system to a weak input signal by noise. The literature described that the sensitivity of muscle spindle receptors to a weak signal is enhanced when a particular level of noise is introduced through the muscle (2, 3). Systematic reviews and meta-analysis demonstrated positive effects on balance, strength and power after sinusoidal whole-body vibration (4-7).

In the recent years whole-body vibration with stochastic resonance are widespread used in the field of rehabilitation. Improvements of postural control and muscle strength are described (8-12). A review is carried out to evaluate effects on postural control after stochastic-resonance-whole body vibration.

The purpose of this systematic review is to provide an overview of the current available evidence for the use of SR-WBV to improve postural control. Following aspects should be clarified in particular: 1) assessment of the quality and internal validity of the studies reviewed; 2) description of the assessments used to document the effect of SR-WBV on static, dynamic and functional balance; 3) composition of the SR-WBV training parameters; and 4) conclusion about the clinical relevance.
2. Research question

The aim of this systematic review is to establish the best evidence regarding random whole-body vibration on static, dynamic and functional balance. Specifically, the research questions are

• what are the effects after stochastic resonance whole-body vibration training on static, dynamic and functional balance?
3. Methods

3.1. Searching design

This systematic review follows the PRISMA guideline. The search strategy aims to find published studies and articles. Following databases was conducted until November 2013:

- CINAHL
- Cochrane Register of Controlled Trials,
- ISI Web of Knowledge
- Physiotherapy Evidence Database (PEDro)
- PubMed.

Hand search:
- Manual search of the reference lists of retrieved publications was conducted.

3.2. Search strategy

3.2.1 Database

CINAHL (n=8)

Search terms: wbv OR whole-body Vibration OR whole-body Vibration OR noise OR stochastic resonance AND elderly people OR older people OR older men OR postmenopausal OR frailty AND balance OR postural stability OR postural control OR gait stability

Cochrane Register of Controlled Trials (n=63)

Search terms: “WBV”, „whole body vibration”, “whole body vibrations”, “whole-body vibration” AND “balance”
Search terms: „WBV“, „whole body vibration“, „whole-body vibration“ und „vibration training“.

PubMed (n=275)

Search terms: ((((((elderly) OR age) OR frail)) AND ((((((((strength)) OR ((rate of force development))) OR ((force))) OR ((functional strength))) OR ((fall))) OR ((falls))) OR ((faller)) OR ((fallers))) OR ((sway))) OR ((postural reaction))) OR ((postural stability))) OR ((postural balance))) OR ((gait stability))) OR ((dynamic stability))) OR (( propriocept*))) OR ((sensori-motor))) OR ((sensorimotor))) AND ((("whole body vibration") OR ("whole body vibrations") OR (Vibration Training[tiab]) OR (stochastic stimulation) OR (stochastic training) OR (stochastic vibration) OR (whole-body vibration) OR (whole-body-vibration) OR (whole-body vibrations) OR (whole-body-vibrations) OR (WBV) OR (sinusoidal vibration) OR (noise vibration AND (therapy OR treatment OR training OR exercise))) OR (stochastic resonance therapy) OR (stochastic resonance treatment)))

3.2.2 Hand search

International Clinical Trials Registry Platform and Google scholar

„whole body vibration“, „WBV“ und „vibration“
4. Study selection

In the first round three reviewers (AS, AV, SR) screened title and abstract. Published randomised (RCT) and non randomised controlled (NRCT) studies were eligible for inclusion. In the next round the three reviewers will independently evaluate the full-text articles and eligibility will be determined by consensus when they met the inclusion criteria. The studies examined the effects of stochastic resonance whole-body vibration on static, dynamic and functional balance on elderly people, patients with Multiple sclerosis, Parkinson’s diseases and neuropathy. Exclusion criteria was sinusoidal WBV, current vibration, vibration via insoles, participants < 65 years and participants with diseases.
5. Data extraction and methodology quality

Three reviewers (AS, AV, SR) assessed independently the methodological quality with “The Cochrane Collaboration’s tool for assessing risk of bias”. The criteria list comprised six items. Each item was scored with “+” if the criterion was met, with “-” if the criterion was not met, and with “?” if the information was not provided or was unclear.

Three authors (AS, AV, SR) independently abstracted the following information from each of the included studies in this systematic review and meta-analysis: 1) design and sample; 2) inclusion criteria; 3) training parameters; 4) type of vibration plate; 5) change in static, dynamic and functional balance; 6) conclusions of the studies and statistical significance.
## 6. Time table

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<th>Date</th>
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References


