

WHOLE BODY VIBRATION EXERCISE: WHAT DO YOU KNOW ABOUT THE SCIENTIFIC INTEREST?

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INTRODUCTION

Vibration is an oscillatory mechanical stimulus characterized by its frequency and amplitude (Cardinale and Bosco, 2005). A possible clinical application of this stimulus, in appropriated conditions, is the exercise in vibration platforms. In these platforms, subjects can stand and receive mechanical stimulus via their feet, and this has been used as whole-body vibration (WBV) exercise (Rønnestad, 2009).

WBV is an important tool to be used in the field of the Health Sciences and this modality of exercise has been utilized in the treatment of some disorders (Rittweger et al, 2002, Roelants et al, 2004) or to improve the physical conditions (Delecluse et al, 2003) or for prevention and management of possible clinical problems in the human beings (Connolly et al, 2003, Rubin et al, 2003). Acute and chronic effects seem to be associated with these actions (Kvorning et al, 2006).

WBV has been associated with the enhancement of the auto force-generating capacity of the lower limbs due to the vibration induces deformation of the tissues leading the activation of muscle spindles eliciting a reflex contraction to modulate the stiffness of the muscles involved. This response is known as tonic vibration reflex (TVR). Moreover, the afferents fibers driven by tendon vibration seem to have important effects on motor unit recruitment and generation of force. In consequence a muscle spindle induced and a tendon induced TVR might be involved in acute increases effects. Moreover, WBV seems to inhibit the agonist-antagonist co-activation through the inhibitory neurons decreasing the protective forces around the joints (Bosco et al, 2001, Rittweger et al, 2001, Cardinale e Bosco, 2003; Kvorning et al, 2006). About the chronic effects, the mechanism by which WBV could influence the neuromuscular and hormonal system would be the increase of the gravitational load on the subject (Cardinale e Bosco, 2003).

Some possible biological risks have been associated with vibration (Neckling et al, 2002), however, authors have reported that at controlled amplitude, frequency and time in the platforms, the mechanical stimulation of the human body is a safe and effective exercise (Rubin et al, 2003).

The mechanical system used in WBV has vibrating plates producing sinusoidal vibrations and the exercises are performed by oscillating plates in some devices, as for example with alternative vertical displacements on the left and right side of the sacrum or whole plate oscillating uniformly up and down (Cardinale and Wakeling, 2005; Abercromby et al, 2007).

The vibrations used in the clinical protocols described using platform, the WBV exercises can have frequencies from 5 to 50 Hz and amplitudes from 1 mm up to 10 mm and the possible combinations of these parameters permit to reach various mechanical conditions to be used (Cardinale and Rittweger, 2006; Cheung W et al, 2007).

In consequence, the scientific interest in WBV exercises can aid to increase the knowledge on the appropriate, safe and effective exercise protocols (Rubin et al, 2003) to be used clinically. The interest of the scientific community in a specific subject can be evaluated by the analysis of the number and quality of published papers. The publication of a paper is as important as the results of the research itself, and is worthwhile (i) to validate the obtained results and conclusions, (ii) to reach the targeted audience, (iii) to stimulate the discussion of a subject, (iv) to introduce new methodologies and (v) to aid to develop safe and effective experimental protocols to be used in clinical and basic research (Santos-Filho et al, 2004, Santos-Filho et al, 2005).

PubMed is a service of the U.S. National Library of Medicine that includes over 18 million citations from MEDLINE and other life science journals for biomedical articles back to 1948. PubMed, which is used as a suitable tool in various publications, provides links to full text articles and other related resources as well as this databank system has been used as a tool in various publications (PubMed (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>)).

The aim of this work is to identify, the scientific interest in WBV, evaluating the number of publications cited per year in PubMed in WBV alone and in the association with some clinical application. Moreover, the acquisition of this information could be useful to develop safe and effective clinical protocols using WBV.

METHODOLOGY

The searches were performed (October 2009) in the PubMed (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>). A search using only the term "whole body vibration" was done to verify number of publication (NPB) in this subject in each year. The percentage of publications per each year (% NPB/year) was determined dividing the NPB in each year by the total of publications in the period that was considered.

A search using the term "whole body vibration" associated with gender, (male or female), or osteoporosis or sarcopenia or cystic fibrosis or postmenopausal or elderly or sarcopenia or Parkinson's disease or osteoarthritis or low-back pain was done, too. The NPB in each association was determined. An interest factor (IFS) was also calculated by dividing the NPB in a specific association by the NPB in WBV.

RESULTS

Figure 1 shows % NPB/year found in the PubMed when the search was done with term whole body vibration alone. It is shown that in the last six years the scientific interest has strongly increased.

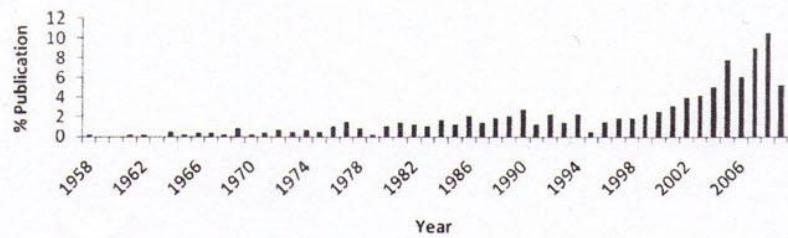


Figure 1- % NPB/year in whole body vibration alone found in PubMed

There are 557 publications with the term "whole body vibration" in the PUBMED. Table 1 shows that the first publication using this term was in 1958. Moreover, if it is considered to each five year since 1958, it is possible to see that the NPB/year increased progressively up to 1988-1992. There is a decrease in 1993-1997, but after this period, a strong increase was found. Furthermore, the % NPB/year is concentrated since 2003 up to 2009 with almost 50% of all the publications.

The number of publications found in the PubMed WBV associated with gender male was 271 (60.22%) and with gender female was 136 (30.22%).

The table 2 shows the number of publications found in the PubMed and the interest factor in whole body vibration associated with some possible clinical conditions treated with WBV and the application of this technique in elderly. It shows a high number of publications, as well as an important interest factor with elderly and low-back pain.

Table 1: The percentage of publications in each five years since 1958

Ano	NP	%P
1958-1962	2	0.52
1963-1967	8	1.38
1968-1972	13	2.25
1973-1977	25	4.33
1978-1982	27	4.67
1983-1987	43	7.44
1988-1992	59	10.21
1993-1997	44	7.61
1998-2002	80	13.84
2003-2007	185	32.01
2008-2009	91	15.74

Table 2- Publications found in PUBMED about whole body vibration and diseases and elderly

	NP	%P
osteoporosis	14	2.53
cistic fibrosis	2	0.36
Postmenopausal	9	1.63
Fibromyalgia	3	0.54
Elderly	119	21.52
Sarcopenia	9	1.63
Osteopenia	11	1.99
Parkinson's disease	5	0.90
Osteoarthritis	3	0.54
Low-back pain	77	13.92

DISCUSSION

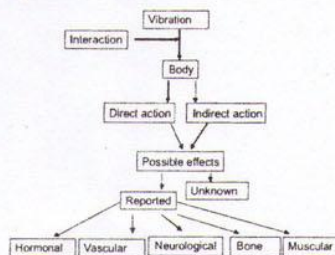
In the WBV exercises, mechanical stimuli are transferred for the body of the subjects when they are standing on the platforms via their feet (Rønnestad, 2009). However, these stimuli can also be transferred to subjects when they are sitting on a platform or with the support of their arms. In these cases, the stimulus could be transferred only for a part of the body, suggesting the term segmental body vibration (SBV) exercises to these situations.

Many studies have been conducted with the aim of understanding the acute (Rittweger et al., 2000) and chronic responses to WBV training (Roelants et al, 2004, Verschueren et al, 2004). Besides the parameters used in the WBV, the characteristics of the patient must also be considered to the protocol utilized might be safe and a successful treatment could be achieved. WBV exercises have been shown to cause clear metabolic responses similar to other forms of exercises. In fact, there are suggested some possible biological actions in different systems due to direct and/or indirect actions due to the WBV exercises that have been published. Moreover, probably, there are some actions that are unknown and they have not been studied yet.

WBV exercises have been shown to acutely enhance strength and power capabilities in well trained individuals (Rønnestad, 2004). Moreover sedentary, injured, and elderly people with impaired muscle activation capabilities may also benefit (Roelants et al, 2004a, Roelants et al, 2004b).

Data from chronic treatment seem to provide more supportive evidence for the possibility of using WBV exercises in various situations, but our results indicated that the elderly (Table 1) could be aided with this technique and scientific attention is available. About 25% of the all the publications in WBV are with elderly. Moreover, the elevated IF obtained with WBV in osteoporosis and osteopenia indicates the importance of this clinical procedure.

Figure 2: Vibration and possible biological effects



The current technology/methods using WBV exercises in platforms produce important improvements in performance well trained athletes and physically active young subjects, but these exercises may be of benefit to the elderly, as little effort is required and this technique is not complicated to be learned. These considerations could justify the increase of the publications found in the PubMed in the different years and a strong increase in the last years (Figure 1 and Table 1). It is also observed that the variability in vibration protocols, in time of the procedure, the frequency and the amplitude, used by different investigators may be an important reason for some inconsistent results that have been reported. Furthermore, as this knowledge is relatively new, it is important to consider to take careful with the reactions of some patients and to establish secure conditions, as to stay near of the effect that is on the platform.

CONCLUSIONS

Current evidence indicates that WBV exercises on platforms may be an effective intervention for musculoskeletal disorders in trained and untrained, as well as in older and in rehabilitation programs. Moreover, the scientific community would be interested in knowing more about this kind of exercises, as it can be seen with their increase of publications in the last years. In consequence, it is necessary to take care with the people that are undertaken WBV exercises because to their individual conditions and due to the limited scientific information in the literature.

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ABSTRACT

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