215 - 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, 2003, Cardinale and Wakeling, 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 known 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, 2004). Acute and chronics 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 the tendon vibration seem to have important effects on motor unit recruitment and generation of force. I 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, 1999; 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 a fulcrum 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 up to 60 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, includes 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 the 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 osteopenia 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 was shown that in the last six years the scientific interest has strongly increased.

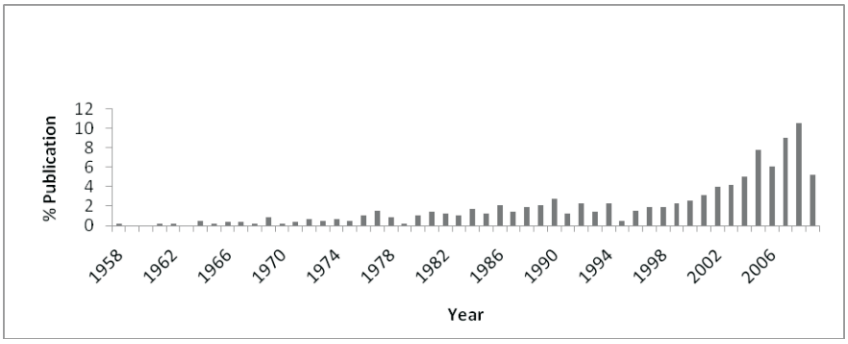


Figure 1- % NPB/year in whole body vibration alone found in PubMed

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 is 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 is shown 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

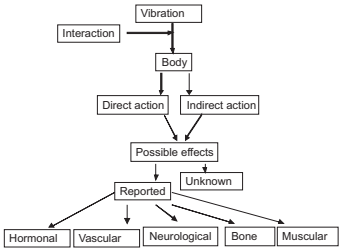
In the WBV exercises, mechanical stimuli are transferred for the body of the subjects when they are stood in vibration platforms via their feet (Rønnestad, 2009). However, these stimuli can also be transferred to subjects when they are sat on the platform or with the support of their arms. In these cases, the stimulus could be transferred only for a part of the body and we are 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 , 2000) and chronic responses to WBV training (Roelants et al, 2004, Verschueren et al, 2004). Besides the parameters used in the WBV, the clinical 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 Figure 2 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 reported yet.

WBV exercises have been shown to acutely enhance strength and power capabilities in well trained people (Ronnestad, 2004). Moreover sedentary, injured, and elderly people with impaired muscle activation capabilities may also be 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 information are available. About 25% of the all the publications in WBV are with elderly. Moreover, the elevated IF obtained with WBV and 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 in 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 a relevant 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 subject 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 interest 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 reactions and due to the limited scientific information in the literature.

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

ABSTRACT

Vibration is an oscillatory mechanical stimulus characterized by its frequency and amplitude. A possible clinical application of this stimulus, in appropriated conditions, it is the exercise in vibration platforms (whole body vibration). In

consequence, the scientific interest in WBV exercises can aid to increase the knowledge on appropriate, safe and effective exercise protocols. PubMed is a service of the U.S. National Library of Medicine and the aim of this work is to identify, the scientific interest in WBV, evaluating the number of publications cited per year in the PUBMED in WBV alone and in the association with some clinical application. The searches were performed (October 2009) in the PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi). It was shown that in the last six years the scientific interest in WBV exercise has strongly increased. It is shown a high NPB with elderly and low-back pain. The current evidence indicates that platforms can generate vibrations and the WBV exercises may be an effective intervention for musculoskeletal disorders in trained and untrained, as well as in older. Moreover, the scientific community would be interest in knowing more about this kind of exercises, as it can be seen with the 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 reactions and due to the limited scientific information in the literature. The presence of a professional when a person is undertaken a WBV in vibration platform is desirable.

KEY WORDS: whole body vibration exercises, vibration platform, PUBMED, elderly

VIBRATION DU CORPS ENTIER EN PLATEFORME (WBV) : QUE L'ON DOIT SAVOIR CONCERNANT L'INTÉRÊT SCIENTIFIQUE ?

RÉSUMÉ

Vibration est un mouvement d'oscillation au tour d'une position d'équilibre dont les variables biomécaniques charactéristiques de son intensité sont la fréquence et l'amplitude. L'application clinique possible d'un stimulus mécanique, dans certains conditions, à des segments corporels entiers définit l'exercice de vibration whole body vibration (WBV). Comme résultat, l'intérêt cientifique sur les exercices WBV peut améliorer d'une façon appropriée, plus sûre et effective, les protocoles employés. Objectif de ce travail est d'identifier l'intérêt scientifique en WBV, et d'évaluer le nombre de publications citées par année dans PubMed, la base de données bibliographiques MEDLINE - National Library of Medicine, concernant soit WBV seulement soit WBV associé à des applications cliniques. Dans cet but, les recherches sur PubMed ont été dévélopées au mois de octubre-2009 (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi). On a pu constaté que, dans les six dernières années, l'intérêt scientifique a beaucoup augmenté, avec un haut NPB sur les effets de la sénescense et les douleurs lombaires. L'évidence indique que les plateformes peuvent générer vibratrions et les exercices par WBV peuvent intervenir effectivement sur des troubles musculosquelettiques aussi bien pour des personnes entraînées et non entraînées que pour les personnes âgées . En plus, la communauté scientifique pourrait être intéressée à connaître davantage ces types d'exercices, comme a pu être remarqué par l'accroissement du nombre de publications ces dernières années. En conséquence, il faudra faire attention aux personnes qui s'entraînèrent par WBV pour ce qui concerne les effets adverses, encore peut évalué dans la litterature scientifique. La présence d'un professionnel lors de la pratique de WBV est ainsi recommandée.

MOTS-CLÉS: whole body vibrations, plateforme de vibration, PubMed.

EJERCICIOS DE CUERPO COMPLETO MEDIADOS POR VIBRACIÓN: ¿QUÉ SE SABE ACERCA DEL INTERÉS CIENTÍFICO?

RESUMEN

La vibración es un estímulo mecánico caracterizado por ser un movimiento oscilatorio cuyas variables físicas más importantes que terminan su intensidad son la frecuencia y la amplitud. Una aplicación clínica posible para éste estímulo, con las variables apropiadas, es la realización de ejercicios sobre las plataformas vibratorias, definidos como ejercicios de todo el cuerpo (ETC). Como consecuencia, el interés científico en ETC puede colaborar en el desarrollo de protocolos apropiados, seguros y eficaces. PubMed es un servicio de U.S. National Library of Medicine y el objetivo de este trabajo es identificar el interés científico evaluando el número de publicaciones (NP) citadas por año en PubMed acerca de solo ETC y asociado con algunas aplicaciones clínicas. Las búsquedas fueron realizadas (octubre de 2009) en PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi). Fue demostrado que en los últimos 6 años el interés científico en ETC se incrementó intensamente. Hay un elevado NP en ancianos y dolor lumbar. La presente evidencia indica que las plataformas vibratorias y los ETC pueden ser un tratamiento efectivo para las alteraciones músculo-esqueléticas en las personas entrenadas, no entrenadas y ancianos. La comunidad científica tiene interés en conocer más acerca de ese tipo de ejercicio, como puede ser observado a través del incremento sobre las NP en los últimos años. Es necesario asistir a las personas que realizan ETC en las plataformas vibratorias, debido a las respuestas individuales, y buscar más informaciones científicas porque aún existe poco material. La presencia de un profesional cuando un individuo está realizando ETC es necesaria.

PALABRAS CLAVE: ejercicios de todo el cuerpo, plataformas vibratorias, PubMed

EXERCICIOS DE VIBRAÇÃO NO CORPO INTEIRO: O QUE VOCÊ SABE SOBRE O INTERESSE CIENTÍFICO?

RESUMO

Vibração é um estímulo mecânico oscilatório cujos parâmetros físicos mais importantes que a caracteriza é a freqüência e a amplitude. Uma aplicação clínica possível para esse estímulo, em condições apropriadas, é o exercício em plataformas vibratórias, exercícios de corpo inteiro (ECI). Em conseqüência, o interesse científico in ECI pode ajudar no aumento do conhecimento de protocolos apropriados, seguros e eficazes. PubMed é um serviço da U.S. National Library of Medicine e o objetivo desse trabalho é identificar o interesse científico, avaliando o número de publicações (NP) citadas por ano no PUBMED em ECI sozinho e em associação com algumas aplicações clínicas. As pesquisas foram feitas (Outubro de 2009) no PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi). Foi mostrado que nos últimos seis anos o interesse científico em ECI aumentou intensamente. Um elevado NP em idoso e dor lombar. A presente evidência indica que as plataformas que possam gerar vibrações e os ECI podem ser uma intervenção efetiva para alterações musculoesquelética em pessoas treinadas e não treinadas e em idosos. Mais ainda, a comunidade científica teria interesse em conhecer mais sobre esse tipo de exercício, como pode ser visto pelo aumento no NP nos últimos anos. Em conseqüência é necessário atenção com as pessoas que realizam ECI em plataformas vibratórias devido as suas reações individuais, assim como as informações científicas que ainda são limitadas. A presença de um profissional quando uma pessoa está realizando ECI em uma plataforma vibratória é desejável.

PALAVRAS-CHAVE: exercício de corpo inteiro, plataforma vibratória, PubMed, idoso

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