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Review

Postmenopausal/menopause, bone mineral density and whole body vibration: a short review

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The alteration of the bone mineral density (BMD) in the postmenopausal is related directly with the osteoporosis which frequently causes impaired in the physical, psychological and social life of the patients due to possible fractures or pain. Investigations about the effectiveness of the action of the vibration produced in oscillating platforms to treat postmenopausal women would be welcome. The aim of this work is to present a review about the published papers found in the PubMed in which there are information about the use of the whole body vibration (WBV) in postmenopausal women. As the increase of scientific interest in postmenopausal is evident, it was also evaluated, in the PubMed, the number of publications (NP) related with postmenopausal, some modalities of treatment and possible symptoms. The NP found in the PubMed in three keywords that can be used to study phenomena related with old women. It is verified that with the term menopause is found the biggest NP in the PubMed. The symptom with the biggest scientific interest, considering the NP is the hot flashes. A limited NP involving WBV exercises is found, that was bigger with postmenopausal than menopause. It is observed a strong interest in the studies involving osteoporosis and BMD. A small NP in menopause or postmenopausal with keywords involving BMD or osteoporosis and WBV was found. Twenty-six publications were analyzed and thirteen of them were common in at least two analyses. Eight papers were selected to be discussed. In general, all the authors agree that the WBV exercise can be a suitable therapeutic for preventing/reversing sarcopenia and possibly osteoporosis. In conclusion, the use of the PubMed to evaluate the scientific interest in menopause/postmenopausal is important; however the appropriate chose of the keyword is necessary. Although authors have described the relevance of the WBV exercises for the older women in menopause/postmenopausal, a small NP is found.

Keywords: Menopause; bone mineral density; whole body vibration; PubMed.

INTRODUCTION

The climacteric is the transition from productive to unproductive period, which happens due to the decrease of hormonal activity and menopause occurs during the climacteric. Natural menopause is recognized to have occurred after 12 consecutive months of amenorrhea for which there is no other pathologic or physiologic cause

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(Weismiller, 2009). Menopause is the permanent end of menstruation and fertility and it depends on the loss of follicular activity in the ovaries, during the period of aging. The onset of climacteric symptoms appears to involve, in general, reduced estrogen, changes in social environmental, and changes in psychological factors. A woman who has not menstruated within at least 12 months retrospectively is deemed to have entered the phase of menopause. Nevertheless, the menopause is also found in women that have been submitted to specific surgery and radiotherapy. The postmenopausal period starts from this moment (Teoman et al, 2004; Ueda, 2004).

For many women, the postmenopausal transition is a troublesome period of life, often associated with decreased well-being and a number of symptoms and some other disorders (Weismiller, 2009; Lindh-Astrand et al, 2007). Depending on the level of the dysfunction of the ovarian physiology and, therefore, lack of estrogen in the postmenopausal period, several symptoms such as hot flashes, irritability, sleeping disorders, fatigue, anxiety, loss of concentration are observed in the early period. Furthermore, the risk of cardiovascular disease and urinary incontinence increase due to the loss of protective effects of estrogen in the late period.

If it is assumed that the menopause age, in general, is beginning about 50, and in this case, women may spend one-third of their lives with undesirable biological changes that they are exposed to in the postmenopausal period (Teoman et al, 2004; Messinger, 2002; Vandenakker and Glass, 2002). Some authors have reported that dysfunctions in this period associated with psychological factors can affect adversely the quality of life of women (Teoman et al, 2004; Lindh-Astrand et al, 2007; Texon and Marquez-Celedonio, 2006; Cheng et al, 2007).

The impact of menopause on health or sexual activity is still imprecise. Appropriate questions have either not been asked or their outcomes are unclear (Weismiller, 2009; Cawood and Bancroft, 1996). The health of the women has in part been connected with reproduction and gynecological issues (Hunter and Orth-Gomer, 2003), and many practicing physicians believe that the period at or following menopause is associated with health-related problems (Greendale et al, 1999) and with less sexual activity than before (Stadberg et al, 2000; Dennerstein et al, 2001). As an indirect example of health and well-being, a recent biological finding linked a woman's long late-life period after menopause with an increased number of offspring (Lahdenperä et al, 2004).

As in general, the symptoms that are found in the menopause are associated with the decrease of estrogen, the hormone replacement treatment is used as a standard therapy in menopausal treatment. The effects of exercise on the prevention of the postmenopausal symptoms have been discussed and accepted. Authors have reported that postmenopausal symptoms can be prevented significantly by encouraging the women over middle age to gain the habit of exercising regularly (Teoman et al, 2004; Shangold, 1998; BrownGoehl, 2000; Heinemann et al, 2008). Researchers have shown that postmenopausal women living in cities are more sedentary. As expected, due to unbalanced and single type nourishment, weight gain is a general phenomenon in the women living in rural areas. It is common knowledge that when women reach the menopause, they put on weight and change body shape (Heinemann et al, 2008). The weight increase depends on age, inactivity and hormone drugs used in menopause. It is minimized by regular exercise and the burning of excess calories (Snow et al, 2000; Marcus, 2001; Nied and Franklin, 2002). In the literature, there are studies that research the effects of exercise on the muscle strength, bone mineral density and on the postmenopausal symptoms in the women in postmenopausal period (Sharkey et al, 2000). In addition, the studies, in which the effects of exercises on physical fitness and quality of life are researched, are insufficient. In accordance, searches have aimed to determine the effects of exercise on physical fitness and quality of life with a controlled exercise program of 6 weeks appropriate to the postmenopausal period (Ueda, 2004).

The alteration of the bone mineral density in the postmenopausal is related directly with the osteoporosis which frequently causes impaired in the physical, psychological and social life of the patients due to possible fractures or pain (Oleksik et al, 2000; Kawate et al, 2010). Some studies have demonstrated that whole body vibration exercises could be a good option to improve the bone mineral density in women in postmenopausal (Slatkovska et al, 2010). Authors have demonstrated that the exercises in oscillating platforms generating whole body vibration improve isometric/dynamic leg muscle strength (Roelants et al, 2004), bone mineral density (Dolny and Reyes, 2008; von Stengel et al, 2010), cardiovascular parameters (Bogaerts et al., 2009), body balancing ability (Cheung et al., 2007). Moreover, the health-related quality of life is increased and the fall risk is decreased (Bruyere et al., 2005). Improvement of gait and balance with WBV has furthermore been shown in a population of nursing home residents (Bruyere et al., 2005).

Vibrations can be defined as an oscillatory motion. The can be generated in oscillating platforms and transmitted, in general, by the feet to whole body of a person. (Bressel et al., 2010). Parameters, as the frequency and the amplitude of the sinusoidal vibration must be controlled by the professional that is supervising the clinical procedure. The duration of the work, as well as, the time to rest, the number of sets in a session, are also controlled. All these conditions depend on, mainly, the clinical and physical conditions of the patient (Cardinale and Wakeling, 2005; Santos-Filho et al., 2010). In addition Marin et al (2009) have studied the

neuromuscular activity during whole-body vibration of different amplitudes, besides the footwear conditions.

Direct and indirect actions are probably related to the effects of the whole body vibration (Santos-Filho et al., 2010) and the indirect effects might to be associated with the neuroendocrine system (Prisby et al., 2008).

Whole body mechanical vibration on the muscle performance would be due to the activation of a tonic excitatory effect, the tonic vibration reflex ((Romaiguere et al., 1993; Torvinen et al., 2002). Furthermore, some authors have described that, potentially, repeated muscle contractions might exert endocrine and/or metabolic effects (Di Loreto et al., 2004). Furthermore, Whole body vibration would act through repetitive sensorial-motor stimulation (Ebersbach et al., 2008)

Putting together the findings reported in the literature, investigations about the effectiveness of the action of the vibration produced in oscillating platforms that is a low cost physiologic strategy, to treat postmenopausal women would be welcome. The aim of this work is to present a suitable review about the published papers found in the PubMed in which there are information about the use of the whole body vibration in postmenopausal women. Moreover, as the increase of interest of the scientific community in postmenopausal is evident in the world, it was also evaluated, in the PubMed, the number of publications related with postmenopausal, some modalities of treatment, possible symptoms, libido, cardio-vascular disease, urinary incontinence and osteoporosis. Moreover, the acquisition of this information could be useful to develop social programs to try to minimize the disturbances of the menopause.

MATERIALS AND METHODS

PubMed is a service of the U.S. National Library of Medicine that includes over 19 million MEDLINE citations and other life science journals for biomedical articles back to the 1950s. PubMed, which is used as a suitable tool in various publications, includes links to full text articles and other related resources. Rees (2007) has reviewed the use of estrogen and non-estrogen-based treatments as well as alternative and complementary therapies in gynecological cancer survivors in whom ovarian function has been ablated through surgery (oophorectomy), radiotherapy or chemotherapy. Kahlenborn et al (2006) had performed a meta-analysis of case-control studies that addressed whether prior oral contraceptive (OC) use is associated with premenopausal breast cancer using the MEDLINE and PubMed databases and bibliography reviews to identify case-control studies of OCs and premenopausal breast cancer published in or after 1980. Santos-Filho et al (2005) have evaluated the scientific interest in the Chinese traditional medicine and more specifically in the moxabustion.

The searches were performed in PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi) on May 30th 2010.

A search using the keywords menopause, postmenopause and postmenopausal was done to verify the number of publication.

Another search was performed using postmenopausal or menopause with some symptoms associated as hot flashes, irritability, sleeping disorders, fatigue, anxiety, vaginal dryness and loss of concentration.

A search involving postmenopausal or menopause and some possible clinical effects, as cardiovascular disease and urinary incontinence was also carried out.

A search with postmenopausal or menopause and “sexual activity” or libido or dyspareunia or vaginismus was also performed.

A search was done, using the keyword postmenopausal or menopause associated with possible modalities of treatment related to posmenopausal, as hormone, drug, exercise, physiotherapy and “whole body vibration”.

A search was performed, using the keyword postmenopausal or menopause associated with osteoporosis, falls, fracture and “bone mineral density”.

The publications involving (i) “whole body vibration” and menopause or postmenopausal, (ii) osteoporosis and “whole body vibration” and menopause or postmenopausal and (iii) “whole body vibration” and “bone mineral density” and menopause or postmenopausal were considered to be evaluated. Only the papers written in English were considered to be discussed.

RESULTS

Table 1 shows the number of publications found in the PubMed in three keywords that can be used to study phenomena related with old women. It is verified that with the term menopause is found the biggest number of publications in the PubMed.

Table 2 shows the number of publications found in PubMed in menopause and postmenopausal and some symptoms associated, as hot flashes, irritability, sleeping disorders, fatigue and anxiety and vaginal dryness. The number of publications is always bigger with the keyword menopause than with postmenopausal. The symptom with the biggest scientific interest, considering the number of publications is the hot flashes.

Table 3 shows the number of publications found in PubMed in postmenopausal and menopause and some possible clinical effects, as cardiovascular diseases and urinary incontinence. It is shown an important interest in studies involving cardiovascular diseases and menopause, however, the difference to the keyword postmenopausal is relatively small.

Table 4 shows the number of publications in menopause or postmenopausal with some clinical conditions related with the sexuality (“sexual activity” or libido or dyspareunia or vaginismus). The number of publications about menopause is always bigger than with postmenopausal. Moreover, a strong scientific interest in the studies involving libido is found in comparison with the other conditions.

Table 5 shows the number of publications in postmenopausal or menopause with some possible modalities of treatment of the symptoms or clinical conditions. It is observed a strong interest in the studies related to the hormones. Moreover, the number of publications in the subjects studied using menopause or postmenopausal are similar. A limted number of publications involving whole body vibrations exercises is found, that was bigger with postmenopausal than menopause.

Table 1. Number of publications found in the PubMed with keywords used in studies related with old women

Keyword	Number of publications
Menopause	44819
Postmenopausal	36712
Postmenopause	15166

Table 2. Number of publications found in the PubMed in postmenopausal and menopause with some symptoms associated

Symptoms	Number of publications in menopause	Number of publications in postmenopausal
Hot flashes	1456	771
Irritability	95	36
Sleeping disorders	447	201
Fatigue	236	126
Anxiety	609	243
vaginal dryness	306	189

Table 3. Number of publications found in the PubMed in postmenopausal and menopause and some possible effects related to postmenopausal

Clinical effects	Number of publications in menopause	Number of publications in postmenopausal
Cardiovascular diseases	1952	1551
Urinary incontinence	518	321

Table 4. Number and the percentage of publications found in the PubMed in postmenopausal and menopause and some clinical conditions related with the sexuality

Clinical condition	Number of publications in menopause	Number of publications in postmenopausal
Sexual activity	172	99
Libido	461	226
Dyspareunia	251	143
Vaginismus	2	1

Table 5. Number and the percentage of publications found in the PubMed in postmenopausal and menopause and some possible modalities of treatment related

Treatment	Number of Publications in menopause	Number of Publications in postmenopausal
Hormone	23605	18574
Drug	14966	14706
Exercise	1775	1729
Physiotherapy	263	263
Whole body vibration	4	16

Table 6. Number and the percentage of publications found in the PubMed in menopause or postmenopausal and the bone framework

Phenomena	Number of publications in menopause	Number of publications in postmenopausal
Osteoporosis	6254	12794
Falls	194	384
Fracture	2353	5858
"bone mineral density"	2921	5021

Table 7. Number of publications found in the PubMed in menopause or postmenopausal and whole body vibration and bone mineral density

Phenomena	Number of publications in menopause	Number of publications in postmenopausal
"whole body vibration"	4	16
Osteoporosis and "whole body vibration"	10	2
"whole body vibration" and "bone mineral density"	1	1

Table 6 shows the number of publications found in PubMed in menopause or postmenopausal with keywords related with bone framework. It is observed a strong interest in the studies involving osteoporosis and bone mineral density. Moreover, the number of publications in these subjects related with the bone framework is bigger with the keyword postmenopausal than with menopause.

Table 7 shows the number of publications found in PubMed in menopause or postmenopausal with keywords involving bone mineral density or osteoporosis and whole body vibration. A small number of scientific investigations is found with these subjects. In consequence, we decided to consider the ten publications found with the mach postmenopausal and Osteoporosis and "whole body vibration". Although, the search with postmenopausal and "bone mineral density" and "whole body vibration" has found only a paper, the system of the pubmed databank has shown eight publications. The search with the match osteoporosis and "whole body vibration" and "bone mineral density" has also found one publication and the pubmed system has indicated a result with eight. These twenty-six publications were analyzed and thirteen of them were common in at least two analysis. Finally, thirteen papers were analyzed. Only the papers in English were considered to be discussed in this work and two publications (one in Russian and other in German) were deleted. Moreover, a paper involving a study of the effects of whole body vibration on bone mineral density for a person with a spinal cord injury was also not considered. A paper that has presented results only with a group of healthy and young active women was also deleted. An article with results involving only animals was also not considered. Eight papers were selected to be discussed and they are shown in Table 7.

Table 8a and Table 8b show the references involving studies about postmenopausal and osteoporosis and "whole body vibration", postmenopausal and "bone mineral density" and "whole body vibration" and osteoporosis and "whole body vibration" and "bone mineral density". Moreover, it is shown the aim of the publications and the clinical findings and conclusions of these publications about the use of the "whole body vibration" to improve the "bone mineral density" in old women.

DISCUSSION

The ageing of the population especially affects women, whose life expectancy, in general, exceeds that of men by almost a decade. The World Health Organization reported that by 2030, there would be 1.2 billion women at and over age of 50. Therefore, although the climacteric seems like a natural process, it is expected that this period must definitely be followed, evaluated and treated to improve the quality of life due to the symptoms or various complaints experienced by the women in the menopause and in the postmenopausal (Weismiller, 2009; Ueda, 2004; Kawate et al, 2010; Villaverde-Gutiérrez et al., 2005; Rao et al., 2008). The importance of these conditions justifies defining the best way to try to find scientific information about the old women. The data

Table 8. Studies about menopause and postmenopausal and osteoporosis and "whole body vibration" and "whole body vibration" and "bone mineral density" and the clinical conclusions

Publication	Aim	Clinical findings and/or conclusion
Slatkvska et al, 2010 (25)	To conduct a systematic review and meta-analysis of (randomized controlled trials) RCTs examining WBV effect on BMD	Clinical findings: Significant but small improvements in BMD was found in postmenopausal women and children and adolescents, but not in young adults. Conclusions: 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.
Von Stengel et al, 2010 (28)	To determine whether the effect of exercise on BMD and falls can be enhanced by WBV. In the "Erlangen Longitudinal Vibration Study" (ELVIS), the authors investigated whether WBV enhances the effect of multifunctional exercise on BMD and falls.	Clinical findings: An increase in BMD at the lumbar spine was observed in both training groups, conventional training group including vibration (TGV) and conventional training group (TG). The difference between the TG and the wellness control group (CG) was significant. At the hip no changes were determined in either group. The fall frequency was significantly lower in TGV compared with CG, whereas the difference between TG and CG was not significant. Conclusion: A multifunctional training program had a positive impact on lumbar BMD. The application of vibration did not enhance these effects.
Dolny et al, 2008 (27)	To review the acute and chronic effects of WBV exposure, discuss the potential neuromuscular mechanisms, provide examples of typical WBV training regimens, and provide insight into potential use of WBV for unique populations.	Clinical findings: WBV alone will provide limited or no benefit in improving muscle strength and/or jumping performance compared with similar exercise training without WBV in young, fit subjects. In sedentary and elderly subjects, there is a greater likelihood for WBV to improve muscle performance to at least the same if not greater extent than traditional training methods. Conclusion: Using WBV to maintain or improve BMD has shown promise, with results from longer, randomized control trials supporting the efficacy of WBV training.
Gusi et al, 2006 (44)	To compare the effects of WBV using a reciprocating platform at frequencies lower than 20 Hz and a walking-based exercise program on BMD and balance in post-menopausal women.	Clinical findings: BMD at the femoral neck in the WBV group was increased by 4.3% compared to the Walking group. In contrast, the BMD at the lumbar spine was unaltered in both groups. Balance was improved in the WBV group but not in the Walking group. **Conclusion:** The 8-month course of vibratory exercise using a reciprocating plate is feasible and is more effective than walking to improve two major determinants of bone fractures: hip BMD and balance.
Iwamoto et al, 2005 (45)	To determine whether WBV would enhance the effect of alendronate (ALN) on lumbar BMD and bone turnover, and reduce chronic back pain in postmenopausal women with osteoporosis.	Clinical findings: The increase in lumbar BMD and the reduction in urinary N-terminal telopeptides of type I collagen and serum serum alkaline phosphatase levels were similar in the ALN and ALN+WBV groups. However, the reduction in chronic back pain was greater in the ALN+ WBV group than in the ALN group. Conclusion: It is suggested that WBV exercise using a Galileo machine appears to be useful in reducing chronic back pain, probably by relaxing the back muscles in post-menopausal osteoporotic women treated with ALN.

Table 8 Cont.

De Zepetnek et al, 2009 (46)	To provide an overview of the physiological basis for the potential effects of WBV on the skeletal system, to review WBV-related terminology and safety considerations associated with the use of WBV as an intervention, and to summarize the literature regarding the use of WBV as an intervention for preventing bone density decline or improving bone mass among astronauts, older adults, and individuals with physical or neurological impairments.	Clinical findings: . Although studies demonstrate that WBV may positively affect bone density, any effect of WBV observed in adults is likely due to a prevention of bone loss. Conclusion: This paper provides an overview of WBV terminology, safety considerations, and a summary of the current literature. It is intended for rehabilitation healthcare providers considering WBV as a potential thrapy for individuals with osteoporosis
Verschueren et al, 2004 (47)	To assess the musculoskeletal effects of high-frequency loading by means of WBV in postmenopausal women with a randomized controlled trial.	Clinical findings: No vibration-related side effects were observed. Vibration training improved isometric and dynamic muscle strength and also significantly increased BMD of the hip. No changes in hip BMD were observed in women participating in resistance training or age-matched controls. **Conclusion:** These findings suggest that WBV training may be a feasible and effective way to modify well recognized risk factors for falls and fractures in older women and support the need for further human studies.
Prisby et al, 2008 (36)	To summarize the physiological responses of several organ systems in an attempt to link the global influence of WBV.	Clinical findings: Investigations in the literature provide some evidence of the effectiveness of WBV in enhancing skeletal mass in the elderly, in individuals with low-BMD, and in adolescents. Conclusion: We report findings focused on subject populations that may benefit most from such a therapy (i.e., the elderly, postmenopausal women) in hopes of eliciting multidisciplinary scientific inquiries into this potentially therapeutic aid which presumably has global ramifications.
Cardinale and Rittweger, 2006 (48)	To review the effectiveness of the WBV exercise on musculoskeletal structures. The physiological mechanisms involved in the adaptive responses to vibration exercise are discussed and suggestions for future studies are made.	Clinical findings: Preliminary results seem to recommend WBV exercise as a therapeutic alternative for preventing/reversing sarcopenia and possibly osteoporosis. Conclusion: There is a paucity of well designed studies in the elderly. In particular, there is a lack of understanding of the physiological mechanisms involved in the adaptive responses to vibration exposure, and of the most appropriate vibration parameters to be used in order to maximize gains and improve safety.

BMD – bone mineral density, WBV – whole body vibration

shown in the Tables 1, 2, 3 and 4 indicate that is better to use menopause as keyword than postmenopausal due to the biggest number of publications that is found. However, in the Table 5, practically the number of publications is practically the same with menopause or postmenopausal. However, in the Table 5 and 6, in general, the number of publications is bigger with postmenopausal than menopause. Certainly, these considerations will be relevant to take decision about the selection of a keyword to study phenomena involving climacteric conditions. The keyword menopause alone presents the biggest number of publications (Table 1).

Climacteric symptoms, or various nonspecific complaints experienced by women around the time of menopause or in the period of time of the postemenopausal, can reduce quality of life. Menopause is characterized clinical changes (Weismiller, 2009; Punyahotra et al., 1997; Menditto et al., 1999) and is currently considered an important public health problem associated with a worse health-related quality of life (Weismiller, 2009; Kennet, 1996; McKinlay, 1996; Barile, 1997; Bayles et al., 2000). Several disorders have been associated with the decrease of the ovarian function in the postmenopausal period. These symptoms in the

postmenopausal period affect the quality of life of woman (Teoman et al, 2004; Messinger, 2002; Vandenakker and Glass, 2002; Punyahotra et al., 1997). A discussion about these undesirable conditions associated with menopause has stimulated the acquisition of suitable information to aid the development of social programs. The association of the keyword menopause with symptoms shows that hot flashes is the most studied symptoms related with menopause (Table 2), as well as, the cardiovascular diseases, as the clinical conditions with a strong association with menopause (Table 3). These findings are in agreement with Maltais et al (2009), that have reported that the decrease of estrogen contributes to the loss of the bone mineral density, the redistribution of subcutaneous fat to the visceral area, the increased risk of cardiovascular disease and the decrease in quality of life.

Menopause is a natural process and it is expected that women spend almost one-third of their lives in the postmenopausal period and the number of women in this condition is increasing in the world. The sexual functioning of the women involves several approaches and it is multifaceted and complex, influenced not only by her sexuality but also by the physiological, pathological, and psychological conditions (Kaiser, 2003; Mishra and Kuh, 2006). Some authors have reported that various aspects of the sexual functioning decline with the age, such as level of sexual activity, sexual interest, and capability for orgasm (Weismiller, 2009; Mishra and Kuh, 2006; Dennerstein et al., 2003). Natural menopause is associated with an overall decline in estrogen levels that can lead to a loss of vaginal lubrication and vaginal narrowing and shortening. This may result in dyspareunia, vaginitis, and reflex muscle tightening, which could affect sexual desire, sexual responsiveness, and sexual satisfaction (Mishra and Kuh, 2006; Bachmann and Leiblum, 2004). Moreover, Avis et al (2000) have reported that menopausal symptoms are one of many factors affecting sexual interest among women in midlife and older age and this could justify the results shown in the Table 4. The studies about postmenopausal and libido present an important interest. Intrigue, the number of publications with postmenopausal or menopause and vaginismus is negligible.

Hormone replacement therapy is considered an effective and well-established form of treatment for climacteric symptoms worldwide (Weismiller, 2009; Heinemann et al, 2008). However, adverse reactions such as risk of onset breast and endometrial cancer have been reported. Independently on the interpretation, there is an important interest in the studies putting together the menopause and the hormone as it is shown in the Table 5. Moreover, findings have revealed that climacteric symptoms are related to lifestyle habits such as diet, exercise, and rest (Kouno, 1998; Sugiyama, 1996). Several studies found that 10 to 12 weeks of aerobic exercise alleviated climacteric symptoms (Slaven and Lee, 1994; Kawakubo and Motoki, 1995). However, only a small number of publications were found with postmenopausal and exercise probably due to this kind of treatment is not still well known. If it is considered the postmenopausal and physiotherapy subjects only a limited number of publications are found in the PubMed. A further discussion about this finding is very important due to the characteristics of the procedures of the physiotherapy. Naturally, the exercise could be considered as physiotherapy, but other physiotherapeutic techniques could be associated, as the respiratory exercises, corporal corrections, corporal manipulations, acupuncture and exercises in oscillating platforms. An important aspect of the physiotherapy is to be, in general, inexpensive and safe and can be planned to each people. The potentiality of the whole body vibration exercises has not been exploited yet to be used in the women in postmenopausal, as this can be seen due to the limited number of publications involving whole body vibrations and menopause or postmenopausal (table 5).

Osteoporosis is a disorder that has been related with postmenopausal (Weismiller, 2009; Teoman et al, 2004) and this fact could justify the elevated number of publications that was found in the PubMed with postmenopausal and osteoporosis (Table 6) and other subjects involving the bone framework. Moreover, an important number of publications was also found when the keywords postmenopausal and fracture or bone mineral density. The alteration of the bone mineral density has been suggested as a relevant condition to the appearance of fracture due to the osteoprosis (Weismiller, 2009; Teoman et al, 2004).

As the whole body vibration exercises seems to improve the bone mineral density (Slatkovska et al, 2010; Dolny and Reyes, 2008; von Stengel et al, 2010) in women in postmenopausal, a search with these keywords was performed. As it is shown in the table VII, a small number of publications is found.

Due to the possibility of the whole body vibration to increase the quality of life of women in postmenopausal, papers were selected to be presented in the Table 8. In general, all the authors agree that the WBV exercise can be a suitable therapeutic for preventing/reversing sarcopenia and possibly osteoporosis. An increase of the bone mineral density in some structures related with the bone framework has been reported is some papers (Slatkovska et al, 2010; Dolny and Reyes, 2008; von Stengel et al, 2010; Prisby et al., 2008; Gusi et al., 2006; Totosy de Zepetnek et al., 2009; Verschueren et al., 2004; Cardinale and Rittweger, 2006). The findings of one paper (Iwamoto et al., 2005) are not conclusive about the action of the whole body vibration to improve the bone mineral density. This fact is related due to this work uses alendronate together with whole body vibration, and a control only with the whole body vibration is not used. Moreover, some papers are systematic review or meta-analysis of (Slatkovska et al, 2010; von

Stengel et al, 2010; Gusi et al., 2006; Verschueren et al., 2004) examining the effect of the whole body vibration on the bone mineral density.

Some authors (Slatkovska et al, 2010; Totosy de Zepetnek et al., 2009; Cardinale and Rittweger, 2006; Rehn et al., 2007) recommended that further studies be performed in order to find an ideal combination of various vibration parameters in the oscillating platforms (frequency, amplitude, duration of the work in the platform, rest, number of session and body position) for full effect and with a specific body region and function in target to determine the functional importance.

CONCLUSION

In conclusion, the use of the PubMed as a tool to evaluate the scientific interest in menopause/postmenopausal is important; however the appropriate chose of the keyword is necessary. An important number of publications are found, and a strong interest in studies about the use of hormone, about the symptom hot flash and about libido is observed. The association between menopause/postmenopausal and osteoporosis and fracture is elevated. Although several authors have described the relevance of the whole body vibration exercises for the older women in menopause/postmenopausal, a small number of publications is found in PubMed. Putting together, these information could be useful to plan social programs to aid to understand better and to try to minimize the disturbances of the menopause/postmenopausal, increasing the quality of life of the women.

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