Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Annals of Biological Research, 2011, 2 (5) :240-245
(http://scholarsresearchlibrary.com/archive.html)

Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

The effects of Whole Body Vibration Exercise and subsequent detraining on body balance in elderly females

Jabbar Bashiri*, Hamdollah Hadi, Mahdi Bashiri, Sorayya Narimanpour and Solmaz Kazemi

Department of Physical Education and Sport Sciences, Tabriz branch, Islamic Azad University, Tabriz, Iran

---

ABSTRACT

Balance disorders increase with aging and raise the risk of falls in the elderly. It has been suggested that the exercise efficiently counteracts these age related disorders, reducing the risk of falling significantly. Whole body vibration (WBV) is a novel modality of exercise shown to improve body balance. The aim of the study, therefore, was to identify chronic effects of WBV and subsequent detraining effects on body balance in elderly females. 24 females with average and standard deviation age of 57.83±3.05 yr, weight 67.11±4.58 kg and height 167.94±4.70 cm who all liv ed at home and could perform their daily tasks without help participated in this study. They were randomized consecutively into two Groups: the group submitted for the Whole Body Vibration Training Program for the six week and with 3 sessions per week (WBV Group), consisting of 12 subjects and the Control group, consisting of 12 subjects without intervention. Body balance was evaluated in all subjects, before and immediately after completion the exercise period and 4 week after final session of vibration training(for determined effects of detraining) with using the Timed "Up and Go" test. A T-test and two way repeated measure ANOVA and Tukey post-hoc used to analyze the data ($P \leq 0.05$). Study results showed that WBV training period had a significant effect on body balance ($p \leq 0.05$). Also detraining effects on reducing body balance were significant after four weeks of detraining ($p \leq 0.05$). Whole body vibration specifically considering the methods of this study could be implemented in conjunction with other training interventions for older adults. Those assumptions however, are tentative since further study is required to specifically examine that theory.

Keywords: Whole Body Vibration Exercise, detraining, body balance.

INTRODUCTION

Nowadays, falls are one of the largest public health problems among elderly people due to the high morbidity, mortality and costs for the family and society (1). These falls, a real problem in public health, are the main cause of accidental death in the elderly (2). Failure of balance might be responsible for the falls of elderly people (3). Balance requires a contribution from three areas-namely, information provided by balance sensors (visual, vestibular, and somatosensory), central integration in the brain, and motor response (1). Thus to prevent falls, it is necessary to improve the reception conditions for sensory information from the vestibular, visual and somatosensory systems, so that the antigravity muscles are activated and balance is stimulated (4). One of the means applied for promoting the stimulation mentioned above is the practice of physical activities (5, 6). Thus, it is recognized in the literature that physical activity promotes increased muscle strength, aerobic conditioning, flexibility and balance, and reduces the risk of falls and improves quality of life (7, 8).

Whole body vibration (WBV) is a mode exercise by which an individual stands on a vibration platform that may be oscillating and therefore creating vertical displacement. WBV, as a relatively recent data of exercise science research, requires further investigation since knowledge of effects and methods to elicit effects in various samples are relatively unknown (9). To date, most investigations have reported WBV effects in young samples. For example Torvinen et al (2002) showed improvements in postural sway on a sway platform after 4 min of WBV training in young adults (10)

However, the reported effects of WBV on older adults, are limited and therefore, a dearth of research literature was identified. Furthermore, chronic effects of WBV and subsequent detraining effects within such a sample of older adults are relatively unknown. The aim of the study, therefore, was to identify chronic effects of WBV and subsequent detraining effects on body balance in elderly females.

MATERIALS AND METHODS

Subjects

24 females with average and standard deviation age of 57.83±3.05yr, weight 67.11±4.58kg and height 167.94±4.70cm who all lived at home and could perform their daily tasks without help participated in this study. Moreover, they were free from any disease of the central nervous system and did not show any orthopedic disorder either of the trunk or the lower limbs The subjects were randomized consecutively into two Groups: the group submitted for the Whole Body Vibration Training Program for the six week and with 3 session per week (WBV Group), consisting of 12 subjects and the Control group, consisting of 12 subjects without intervention. All subjects read and signed a term of free informed consent that described the procedures which would be realized during the research and the study approved by the Ethics Committee of the Tabriz University of Medical Sciences.

Data collection

Body balance was evaluated in all subjects, before and immediately after completion the exercise period and 4 week after final session of vibration training(for determined effects of detraining), by a physiotherapist who was blinded to the distinct group (WBV, Control) with using the Timed “Up and Go" test.

The Timed “Up and Go" test measures, in seconds, the time taken by an individual to stand up from a standard arm chair (approximate seat height of 46 cm [18 in], arm height 65 cm[25.6 in]), walk a distance of 3 meters (118 inches, approximately 10 feet), turn, walk back to the chair, and sit down. The subject wears their regular footwear and uses their customary walking aid (none, cane, walker). No physical assistance is given. They start with their back against the chair, their arms resting on the armrests, and their walking aid at hand. They are instructed that, on the word "go" they are to get up and walk at a comfortable and safe pace to a line on the floor 3 meters away, turn, return to the chair and sit down again. The subject walks through the test once before being timed in order to become familiar with the test. Either a stopwatch or a wristwatch with a second hand is used to time the trial (11).

Training protocol

The intervention consisted of 6 weeks of Whole Body Vibration training. The WBV group exercised on a vibration platform (WNQ): squat, deep squat, wide stance squat, toes-stand, toes-stand deep, one-legged squat and lunge. Subjects of WBV group participated in training sessions 3 times a week. The amplitude of the vibration platform was controlled at 0.5mm, while the frequency of the platform was increased in standard with procedures of other WBV studies (12, 13). The frequency of the vibration platform for the first WBV session in week one was 15 Hz and increased to 25 Hz by the last WBV session in week six(table1). Participants were to maintain the posture as accurately as possible for the duration of the WBV bout. Also, participants were told to hold the handlebars for support if required with instructions not to lean on the handlebars so as not to reduce potential WBV effect.

Table1: vibration platform frequency for the six weeks of WBV intervention

intervention	week1	Week2	Week3	Week4	Week5	Week6
Set×Frequency	5×15Hz	2×15Hz 3×20Hz	5×20Hz	2×20Hz 3×25Hz	5×25Hz	5×25HZ

Statistical Analyses

Standard descriptive statistics were used to report means and standard deviation for baseline characteristics. ($P \leq 0.05$). An independent T-test and two way repeated measure ANOVA and Tukey post-hoc used to analyze the data. All data was analyzed by using SPSS for windows software version 17.0 (SPSS Inc, Chicago, IL)

RESULTS

Table 1 shows Personal Characteristics of WBV training and control group. T-test results showed no significant differences between the variables of height weight and age of two groups' subjects that indicated to be homogeneous both groups in these variables. Also in the pretest of TUG, time showed no significant difference between control and experimental subjects (table 2).

Table 1: Personal Characteristics of WBV training and control groups

Variable	group	N	Mean	SD
Age(years)	WBV training	12	57.50	2.39
	control	12	58.10	3.60
Height(cm)	WBV training	12	167.50	3.74
	control	12	168.30	5.53
Weight(kg)	WBV training	12	67.75	3.45
	control	12	66.60	5.46

The results of two way repeated measure ANOVA for TUG test, showed significant difference between time (3 test) and group(2 groups)($F=9.569$, $P \leq 0.05$). Also, main effect of time ($F=11.256$, $P \leq 0.05$) and group ($F= 25.451$, $P \leq 0.05$) was significant. The results of repeated measure ANOVA for any groups, showed significant difference in effect of time in WBV group ($F=15.89$, $P \leq 0.05$), but, significant difference doesn't show in control group ($F=1.16$, $P \geq 0.05$). The results of Tukey post-hoc test for WBV group showed significant difference in pre and post-test, also significant difference showed in post-test and 4 weeks after detraining (table 2).

The results of independent t-test showed that WBV and control groups don't have significant difference in pre-test and 4 weeks after detraining, but, two groups showed significant difference in post-test(table 2).

Table 2: Means and SD of training groups in pre and post test and after 4 weeks detraining and results of tukey test for TUG test

group	Pre-test	Post-test	4 weeks detraining
WBV training	6/72±1/01	5/02±1/45[a,b]	6/29±1/24[c]
control	6/66±1/71	6/8±1/51	6/72±1/32

a: significant difference between WBV and control groups; b: significant difference between Pre and Post test in two groups; c: significant difference between post-test and 4 weeks after detraining in two groups;

DISCUSSION

The aim of the study was to identify chronic effects of WBV exercise and subsequent detraining on body balance in elderly females. Body balance of the elderly females improved after six weeks WBV exercise. These findings are similar to findings of Bosco et al 1999; Torvinen et al 2002; Torvinan et al 2003; Rittwegar et al 2003(10, 14-16). Unlike the present study, those studies recruited young adults of varying athletic ability. Findings from this study, Suggested that WBV can be a useful tool to beneficially affect body balance and decreased of fall risk in another population, specifically, older adult population. One possible explanation for the observed balance improvements was, as had been suggested in the literature, increased synchronous motor unit recruitment. WBV increased muscular fatigue quantifiers (RPE and blood lactate levels) (16). Such process caused enhanced neuromuscular excitability and greater motor unit recruitment (15). Furthermore, the synchronous activity of synergist muscles of the lower limbs or increased inhibition of the antagonistic muscles caused by the activation of the stretch reflex may also explain the observed findings (15). Also, the improvement in muscular strength (2, 13, 14, 17-19), after WBV training and the extensive stimulation of the proprioceptive pathways might be partly responsible for the improvement in body balance found in the present study.

Body balance, therefore, was affected by a six week WBV intervention. Functionally, participants were able to rise from a chair and perform other simulated daily activities with significantly greater motor speed and motor control. Thus, the intervention was successful in eliciting neuromuscular processes that affects performance.

Retention-test data of this study showed that observed improvements in TUG tests times were partly or completely lost after a four week detraining period. The findings of this study, however, are unique since many studies reported contrasting data (20-24). That is, detraining data were lower (poorer body balance) than baseline data after resistance training interventions. Conversely, other studies reported improvement in neuromuscular performance after a detraining period (21, 25). Specifically, after a six week detraining period, lower limb strength gains were maintained in older adults (21). Different methods, however may have contributed to those collective findings. Specifically, effects of detraining were measured over a minimum 12 week and maximum 52 week period in those studies. Lemmer et al (2000) reported most evident performance losses during a detraining period from week 12 onwards for adults after resistance training (26). The findings of the current study identify two issues; (1) that chronic body balance gains elicited by a WBV intervention were reduced after a four week detraining period in older adult sample and; (2) that WBV influenced body balance gains were lost more rapidly than gains from resistance training.

Findings of this study suggest that WBV should not be seen as a replacement to resistance training in older adults as was previously suggested (27). Resistance training appeared to have a more significant influence in delaying sarcopenia in older adults than WBV when considering detraining data of this study. As previously mentioned, WBV is easy to administer and required minimal skill. As shown in previous studies, WBV and resistance training positively affected older adults in combination (12).

Whole body vibration specifically considering the methods of this study could be implemented in conjunction with resistance training interventions for older adults. Those assumptions however, are tentative since further study is required to specifically examine that theory.

Acknowledgement
The authors would like to thank Ms SalehVedadi, Hallaj, Abedzadeh, Ostovar and Abdollahi for their assistance in the personal training of the subjects in this study. We would also like to express our thanks to the subjects who took part in the study. The present study was supported by Research vice-chancellor Islamic Azad University-Tabriz Branch, in Iran.

REFERENCES

[1] JA Stevens, S Olson. *MMWR Morb Mortal Wkly Rep*, **2000**, 49: 1-12.
[2] PW Overstall, AL Johnson, *Age Ageing*, **1978**, 7(suppl): 92-6.
[3] BE Maki, PJ Holliday, AK Topper. *J Gerontol*, **1991**, 46: M123–31.
[4] PR Geigle, WL Cheek, ML Gould, HC Hunt, B Shafiq. *J Aquatic Physical Therapy*, **1997**, 5(1):4-10.
[5] T Masud, RO Morris. *Age Ageing*, **2001**, 30(S4):3-7.
[6] MA Province, EC Hadley, MC Hornbrook, LA Lipsitz, JP Miller, CD Mulrow, et al. *JAMA*, **1995**, 273:1341-7.
[7] EW Gregg, MA Pereira, CJ Caspersen. *J Am Geriatr Soc*. **2000**; 48:883-93.
[8] A Barnett, B Smith, SR Lord, M Williams, A Baumand. *Age Aging*, **2003**, 32: 407-14.
[9] M Cardinal, J Wakeling. *British Journal of Sports Medicine*, **2005**, 39: 585-589.
[10] S Torvinen, P Kannu, H Sievanen, TA Jarvinen, M Pasanen, S Kontulainen. *Clin Physiol Funct Imaging*, **2002**, 22: 145-52.
[11] D Podsiadlo, S Richardson. *Journal of the American Geriatrics Society*, **1991**, 39: 142- 148

[12] O Bruyere, M Wuidart, E DiPalma, O Ethgen, F Richy, J Reginester. *Archives of Physical Medicine and Rehabilition*, **2005**, 86: 303-307.
[13] J Luo, B Mcnamara, K Moran. *Sports Medicine*, **2005**, 35(1): 23-41
[14] C Bosco, R Colli, E Introini, M Cardinale, O Tsarpela, A Madella, et al. *Clin Physiol*, **1999**; 19: 183-7.
[15] S Torvinen, P Kannu, H Sievanen, TA Jarvinen, M Pasanen, S Kontulainen. *Clin Physiol Funct Imaging*, **2002**, 22: 145-52.
[16] J Rittwegar, M Mustchelknauss, D Flesenberg. *Clinical Physiology and Functional Imaging*, **2003**, 23(2): 81-86
[17] C Delecluse, M Roelants, S Verschueren. *Med Sci Sports Exerc*, **2003**, 35: 1033-41.
[18] M Roelants, C Delecluse, SM Verschueren. *J Am Geriatr Soc*, **2004**, 52: 901–8.
[19] SM Verschueren, M Roelants, C Delecluse, S Swinnen, D Vanderschueren, S Boonen. *J Bone Miner Res*, **2004**, 19: 352-9.
[20] N Toraman. Short term and long term detraining: is there any difference between young-old and old people? *British Journal of Sports Medicine*, **2005**, 39: 561-564
[21] N Toraman, N Ayceman. *British Journal of Sports Medicine*, **2005**, 39: 565-568
[22] Fatouros I, Kambas A, Katrabasas I, Chatzinikolaou A, Jamurtas A, Aggelousis N, Taxildaris K. *Journal of Strength and Conditioning Research*, **2006**, 20(3): 634-642
[23] L Telxeira-Salmela, L Santiago, R Lima, F LanaCamargos, J Cassiano. *Disability & Rehabilitation*, **2005**, 27(17): 1007-1012
[24] I Fatouros, A Kambas, I Katrabasas, K Nikolaidis, A Chatzinikolaou, D Leontsini, K Taxildaris. *British Journal of Sports Medicine*, **2006**, 39(10), 776-780
[25] F Ivey, B Tracy, J Lemmer, M Nessaiver, E Metter, J Fozard, B Hurley. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, **2000**, 55: B152-157
[26] J Lemmer, D Hurlbut, G Martel, B Tracy, F Ivey, F Metter, J Fozard, J Fleg, B Hurley. *Medicine& Science in Sport & Exercise*, **2000**, 32(8): 1505-1512
[27] M Roelants, C Delecluse, S Verschueren. *Journal of the American Geriatrics Society*, **2004**, 52: 901-908