Middle-East Journal of Scientific Research 13 (9): 1150-1153, 2013
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2013.13.9.787

The Effect of WBV Training on Decision Making in Male non Athlete Students

Amir Hamze Sabzi and Bahman Hasanvand

Department of Physical Education and Sport Sciences,
Khoramabad Branch, Islamic Azad University, Khoramabad, Iran

Abstract: Whole body vibration training (WBVT) is a new neuromuscular training method which is applied in athletes. The aim of this study was to investigate the effects of WBVT on the choice reaction time of male non-athlete students. For this purpose thirty healthy male students (age: 21.8 ± 1.3 yr) were recruited and randomly divided into an experimental and a control groups (n=15 per group). The WBVT were treated for 12 weeks, 3sessions per week with 5 sets of 1minute in a squat of 110° body position, for a total of five minutes per day. The subjects of the control group were asked to maintain their normal activity. The subjects were tested at the beginning and the end of treatment with a specific functional test. The independent-t test statistical method was used for analyzing the data using SPSS version 16. The results showed a remarkable and statistically significant enhancement in choice reaction time in the experimental group (P=0/002), but no significant difference was found in the control group between pre and post test (P$\geq$0.05). Overall, we can conclude that WBVT probably can have a positive effect on choice reaction time. Hence, WBVT can be use as a new method of training for athletes.

Key words: Whole body vibration · Choice reaction time · Pre motor · Motor time

INTRODUCTION

Many sports and military situations require individuals to respond quickly to unpredictable stimuli. Such Problems are known as response time tasks and require quick reaction and movement. Reaction time (RT) is the period from the presentation of the stimulus to the initiation of the obvious response [1]. It acts as a reliable indicator of rate of processing of sensory stimuli by central nervous system and its execution in the form of motor response [2]. RT can be fractionated into premotor time (PMT) and motor time (MT). The pre motor time is the interval between the imperative stimulus and the first discernible electromyography (EMG). The motor time measures the time from the onset of muscle activities (from EMG) to the onset of movement, designating generation of motor responses. PMT and MT have been used to identify the central (cognitive) and peripheral (neuromuscular) processing in human performance research [3-5]. There are many factors affecting RT, ranging from the nature of the stimulus information to the type of movement being performed [6]. According to Kosinski (2000), these factors are such as number of stimulus-response alternatives, stimulus-response compatibility, arousal, age, gender, type of stimulus, exercise, fasting and stimulant drugs [6].

Whole Body Vibration (WBV) is a mode of exercise by which an individual stands on a vibration platform that may be oscillating and therefore creating vertical displacement. Vibrations are transmitted to the body through the contact point on the surface of the platform. As WBV elicits a high degree of muscle activation, it was hypothesized that WBV would result in strength increase in previously untrained persons [7]. These strength increases should be significantly larger than the training effects resulting from an identical exercise program performed in absence of vibration (placebo condition). As the tonic vibration reflex facilitates the activation of high-threshold motor units and the reflex sensitivity [7, 8]. WBV training may be more efficient to improve ballistic strength and jump performance compared with resistance training at moderate intensity. The neuromuscular response of the body to WBV still remains a topic of interest [9]. Muscle activity appears to increase with WBV exposure as shown by several investigations [10, 11]. This appears to be the result of activation of a

Corresponding Author: Department of physical Education and Sport Sciences, Khoramabad Branch, Islamic Azad University, Khoramabad, Iran. Mob: +989167103201.

nervous system reflex originating from muscle sensors [12, 13]. These mechanisms raise interest as to both the potential acute and chronic influences of WBV on improving athletic performance. WBV, as a relatively recent area of exercise science research, requires further investigation since knowledge of effects and methods are relatively unknown [8]. Reported literature suggested that WBV could improve neuromuscular performance [9, 11, 14, 15]. Hence, with the hypothesis that WBV can improve choice reaction time, the aim of the study, was to identify chroniceffects of WBV on choice reaction time.

MATERIALS AND METHODS

Participants: Thirty healthy male subjects (mean age=21.8 years, SD=1.3) voluntarily participated in this experiment. All subjects read and signed informed consent forms. They were randomly divided into an experimental (age: 21/2±1/32) and control group (age: 21/1±1/12). The subjects were not involved in any athletic side activities.

Procedure: A pre-post design was used in this study to determine whether a 12-wk period of WBV-training (3times/wk) would result in a considerable decrease in choice reaction time. In the pre-test phase, one day before the exercises, the choice reaction time of the subjects was measured. The Vienna software was used to measure choice reaction time. The reaction time Test was conducted in a quiet room without visual or auditory distractions. Participants were positioned in a comfortable, seated position in front of the computer screen. They were instructed to rest their wrist on the keyboard table and place the index finger of their dominant hand on the space bar of the keyboard. Before starting, the subjects were familiarized with the procedure and allowed to practice the reaction time task. The choice reaction time task was presented for 60 seconds on identical display equally positioned in front of the participant. The stimulus appeared in the center of screen and was separated by an irregular fore period varying from 3 to 5 sec. the program flashed an arrow on a screen; the participant was required to respond to the arrow depending on the direction it was presented, either up, down, left or right. The size of the arrow on the screen was large enough to ensure that participants could see the arrow clearly. Response times under 160 millisecond were considered as anticipated responses and counted as errors.

All intervention programs of the experimental group consisted of 36 training sessions within a 12-wk period. Training frequency was three times a week with at least 1 min of rest between two sessions. The control group did not participate in any training program. The amplitude of the vibration platform was controlled at 0.5 mm, while the frequency of the platform was increased in standard with procedures of other WBV studies [11, 14, 15]. The frequency of the vibration platform for the first WBV session in week one was 15 Hz ($g = 0.45$) and increased to 25 Hz ($g = 1.26$) by the last WBV session in week twelve. Each WBV bout lasted one minute with a one minute rest period between bouts [3, 11]. Thus, for one WBV session, a participant received five minutes of WBV. Participants were asked to stand with legs at 110° knee extension during each WBV bout [11, 14]. The angle was set using agoniometer and tested at the beginning, after 30 seconds and at the end of each WBV bout. Participants were asked to maintain the posture as accurately as possible for the duration of the WBV bout. Participants stood with their feet equidistant (16 cm) from the axis of rotation on thevibration platform. Participants were told to hold the handlebars for support if required within structions not to lean on the handlebars so as not to reduce potential WBV effect. During the study, the control group was asked to maintain their body activity and avoid strength exercises. The post-test was completed at least 24 hours after the final vibration session [11, 14]. This test included choice reaction time; both the control and experimental groups were tested.

Data Analysis: We used Kolmogorrov-Smirnov to determine the homogeneity of the groups in pre test. The independent t test was performed comparing differences between the pre and post test. The significance level for the tests was set at $\alpha \leq 0.05$ and the data was presented as mean ± SD. All analyses were executed using the statistical package SPSS 16.

RESULTS

The Kolmogorrov-Smirnov test indicated the homogeneity of both groups in pre test ($P=0.4333$ & $P=0.221$).

The independent t-test indicated no significant difference in the pre-test stage for the control and experimental group. There was significant difference between pre and post test in Experimental group ($P \leq 0.001$) while no statistically significant effects were found for the control group (Table 1).

Table 1: The results of the effect of vibration on the choice reaction time of the studied groups

Group	Phase	Number	m**(ms)±SD	P
Experimental	Pre-test	15	520.94±22.86	0.001*
	Post-test	15	440.26±31.33	
Control	Pre-test	15	515.99±14.94	0.364
	Post-test	15	520.13±12.81	

DISCUSSION

The purpose of this study was to examine the presumable effect of vibration training on choice reaction time. We found a significant influence of 12 weeks of WBV-training on choice reaction time. Though the WBV group did make significant gain in choice reaction time and the control group did not improve, it is quite obvious that there was difference in the posttest reaction time performance between the control and the WBV group. The results support our hypothesis of the WBV-training effects on the reaction time. So the results of this study clearly show a significant decreasein reaction performance when WBV is compared with control group. Such findings are consistent with resultsthat reported a significant effect of WBVT on speed [16, 17] and are inconsistent with the findings of other authors [13]. It is likely that WBV elicits a biological adaptation that is connected to the neural potentiation effect. Recently, it was suggested that resistance training might alter the connectivity between corticospinal cells and spinal motoneurons [18, 19]. Interneurons in the spinal cord receive input from afferent fibers, descending fibers and the fibers of other interneurons and ultimately influence the activity of motoneurons. The interaction of these various inputs onto interneuronal circuitry determines which motor units are recruited during movement. The activation of motoneurons via both corticospinal cells and spinal reflex pathways is partly determined by the manner in which supraspinal and segmental elements interact to set the excitability states of interneuronal circuits. An important consequence of this arrangement is that the same corticospinal output can activate different populations of motoneurons dependent of the state of circuitry within the spinal cord [18]. During WBV, proprioceptive pathways are strongly stimulated. Thevibratory stimulus is activating the sensory receptors thatresults in reflexive muscle contractions.Tonic vibration reflection, higher activation of Motor neurons and muscularspindles and subsequently the increase in motor units, the decrease in EMD due to WBVT have been noticed [8, 9, 11].

At motor unit level, it was suggested that the tonic vibration reflex affects primarily the subjects' ability to generate high firing rates in high-threshold motor units [20]. The recruitment thresholds of the motor units during WBV are expected to be lower compared with voluntary contractions [21], probably resulting in a more rapid activation and training of high-threshold motor units. Therefore, it has been suggested that WBV training renders specific training of fast-twitch fibers [22], which have an important contribution in ballistic strength. Other neurological reasons for speed increase can include the following theories: The theory of muscular coordination indicates the preparation of motor neurons in one practical group of muscles and joints. Also coordination and integration of motorunits, co-contraction of synergist muscles and inhibition of antagonist muscles will be improved [6, 11]. Although evidence exists to prove the coordination of muscles with the help of WBVT, but which frequencyand amplitude have the highest effect is yet unknown [6, 9, 11]. However, higher neural center activation, long loop reflex, hormonal secretions and higher coordination are the most important mechanisms of WBVT [6, 9, 11]. Presumably, the reason behind the inconsistency between the studies is using different exercise protocols with various training variables [7, 16]. Most studies that have reported an increase explosive power and speed after WBVT have used a 30Hz frequency. The highest electrical activity of the muscles has been reported in the 30Hz frequency. If they had not used the 30Hz frequency, they would have used higher duration and amplitude of the vibration [6, 8]. For example Bosco *et al*. (1999) applied a26 Hz frequency, 10mm amplitude and 60-second duration with 10 repeats and 60-second intervals and reported an increase in explosive power. But in another study, 9 sessions of vibration with a frequency of 26 Hz and 11mm amplitude had no significant effecton speed and explosive power [12]. The fact that the training variables in the present study are identical with the consistent studies is the presumed reason for the consistency of the findings of such studies.

To summarize, the present findings clearly indicate the influence of WBV-training on reaction time. So reduction in the reaction time during muscle activation of prime movers could be related to preparation of motor executing pathways for a quick motor response.

ACKNOWLEDGEMENTS

This research was financed from the budget of Islamic Azad University, Khoramabad Branch-Iran.

REFERENCES

1. Magill, RA., 2004. Motor learning: concepts and application. 6th ed. boston : MA:McGraw-hill, 2004.
2. Schmidt, R.A. and C.A. Wrisberg, 2004. Motor Learning and Performance. 3th ed. usa: Human Kinetics, pp: 53-80.
3. The locus of reaction time change with set, motivation and age. Weiss, A.D. s.l.: Journal of Gerontology, 1965, 20: 60-64.
4. Delignieres, D., J. Brisswalter and P. Legros, 1994. Influence of physical exercise on choice reaction time in sports experts-: the mediating role of resource allocation. Journal of Human Movement Studies, 27: 173-188.
5. Levitt, S. and B. Gutin, 1971. Multiple choice reaction time and movement time during physical exertion. The Research Quarterly, 42: 405-410.
6. Kosinski, S.L., R.L. Watts, J.L. Juncos and J.N. Sanes, 2000. Movement amplitude choice reactiontime performance in Parkinson’s disease may be independent of dopaminergicstatus. J. Neurol Neurosurg Psychiatry, 53: 279-283.
7. Cardinale, M. and C. Bosco, 2003. The use of vibration as an exerciseintervention. Exercise and Sports Science Reviews, 31: 3-7.
8. Cardinale, M. and J. Wakeling, 2005. Whole body vibration exercise:are vibrations good for you? British Journal of Sports Medicine, 39: 585-589.
9. Torvinen, S., P. Kannus, H. Sievanen, T. Jarvinen, M. Pasanen, S. Kontulainen, T. Jarvinen M. Jarvinen, P. Oja and I. Vuori, 2002a. Effect of four-month vertical whole body vibration on performance and balance Medicine and Science in Sports andExercise, 34: 1523-1528.
10. Rittweger, J., M. Mutschelknauss and D. Felsenberg, 2003. Acutechanges in neuromuscular excitability after exhaustive wholebody vibration exercise as compared t exhaustion by squatting exercise. Clinical Physiology and Functional Imaging, 23: 81-86.
11. Torvinen, S., P. Kannus, H. Sievanen, T. Jarvinen, M. Pasanen, S. Kontulainen, T. Jarvinen M. Jarvinen, P. Oja and I. Vuori, 2002b. Effect of a vibration exposure on muscular performance and body balance. Randomized cross-over study. Clinical Physiology and Functional Imaging, 22: 145-152.
12. Verschueren, S.M.P., M. Roelants, C. Delecluse, S. Swinnen, D. Vanderschueren and S. Boonen, 2004. Effect of 6-month whole bodyvibration training on hip density, muscle strength and posturalcontrol in postmenopausal women: a randomized controlled pilotstudy. J. Bone Miner Res., 19: 352-359.
13. De Ruiter, C.J., S.M. Van Raak, J.V. Schilperoort, A.P. Hollander and A. deHaan, 2003. The effects of 11 weeks whole body vibration training onjump height, contractile properties and activation of human kneeextensors. Eur. J. Appl. Physiol., 90: 595-600.
14. Ruiter, C., S. Raak, J. Schilperoort, A. Hollander and A. Haan, 2003. The effects of 11 weeks whole body vibrationtraining on jump height, contractile properties and activation of human knee extensors. European Journal of Applied Physiology, 90(5): 595-600.
15. Issurin, V., 2005. Vibrations and their applications in sport. A. The Journal of Sports Medicine and Physical Fitness, 45: 324-336.
16. Cardinale, M., 2002. The effect of vibration on human performance and hormonal profile. Published DoctoralThesis. Semmelweis University Doctoral School, Budapest.
17. Coyle, E., D. Feiring, T. Rotkis, R. Cote 3rd, F. Roby, W., Lee, *et al*., 1981. Specificity of power improvementsthrough slow and fast isokinetic training. Journal of Applied Physiology, 51(6): 1437.
18. Carroll, T.J., S. Riek and R.G. Carson, 2001. Neural adaptations toresistance training: implications for movement control. SportsMed., 31: 829-840.
19. Carroll, T.J., S. Riek and R.G. Carson, 2002. The sites of neuraladaptation induced by resistance training in humans. J. Physiol., 544: 641-652.
20. Bongiovanni, L.G., K.E. Hagbarth and L. Stjernberg, 1990. Prolongedmuscle vibration reducing motor output in maximal voluntarycontractions in man. J. Physiol., 423: 15-26.
21. Romaiguere, P., J.P. Vedel and S. Pagni, 1993. Effects of tonic vibrationreflex on motor unit recruitment in human wrist extensormuscles. Brain Res., 602: 32-40.
22. Rittweger, J., G. Beller and D. Felsenberg, 2000. Acute physiologicaleffects of exhaustive whole-body vibration exercise in man. Clin. Physiol., 20: 134-142.