Review Article

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Improvement in Physical Performance Parameters with Whole Body Vibration

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Abstract

As a training method of performance enhancement in sports, whole body vibration has recently been of increasing interest. However, the mechanisms responsible for the effects of whole body vibration are not sufficiently studied. Whole body vibration includes stimulating the nervous system and the muscles through direct or indirect devices. This paper consist of the review of the articles available in literature published in various journals like biology of sports, journal of strength and conditioning research, European journal of Appl physiol, journal of medicine and journal of physical fitness and performance from 2002 to 2016 about the effect of whole body vibration on the vertical jump height, balance and strength of lower extremities. Whole body vibration has been found to be an effective treatment modality in improving jump height as well as balance.

Keywords: Whole Body Vibration; Counter Movement Jump; Squat Jump; Isokinetic Dynamometer; Shuttle Run.

Introduction

The technology of whole body vibration was developed in the 2nd half of the 20thcentury. It was developed as a way to lessen loss of bone density and muscular mass in astronauts exposed to condition of zero gravity [6-10]. Whole body vibration is also known as indirect vibration.

This is achieved by using a commercially manufactured machine having an oscillatory platform moving in the vertical plane or in the side alternating motion about a central axis. Vertical sinusoidal oscillations are periodically produced by the platform transferring energy to human body.

These oscillations cause rapid eccentric – concentric contractions in the muscles causing muscular performance enhancement mediated by a rapid reflex and stretch reflexes (Ritzman et al 2010). These involve the tonic vibration reflex (Pollock et al 2012). The mechanism involves the stimulating effect of the rapid muscle stretching on the neuromuscular spindles which in turn boost up the myelinatedIafibres (Eklund and Hagbarth, 1973). The thick myelinated Ia fibres then send impulses to the alpha motor neurons in the anterior horn of spinal cord. Other mechanism for the response of whole body vibration may include angiogenic factors (outgrowth of new capillaries from vessels) like Vascular Endothelial Growth Factor [11-14], testosterone, growth hormone [15] and activation of stem cells [16].

As found in the literature, some of the beneficial effects of the whole body vibration are increase in strength and power, bone density improvement, hormonal secretion changes falls prevention etc (Bosco et al., 1999; 2000; Cardinale and Rittweger, 2006;). Various parameters of whole body vibration are vibration frequency and acceleration, exposure time and duration of training, total loading, exercise type and work loading [17, 18].

Jumping is the most important attribute of performance in volleyball players. It has been found that player performing better has high vertical jump values [19]. Whole body vibration has been found to improve vertical jump performance. Also, it has been found that low amplitude, high frequency whole body vibration improves muscle strength and balance of an individual [20-30] .

Various studies evaluating whole body vibration training across various sporting activities and level

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of sports reports the efficacy of WBV in improving performance. Enhancement in performance of explosive activities like vertical jumping are much more reported.

Review of Articles

In one study conducted by Perez – Turpin J.A et. al. in 2014, 23 subellite male volleyball and 11 beach volleyball players were divided in to 2 groups. One of the group received training with whole body vibration for 6 weeks while the other group underwent traditional strength training programme. Measures used to evaluate the performance were the squat jump and countermovement squat jump measured by Ergotester contact platform and maximum leg press(1 RM). Results showed that whole body vibration training leads to much better improvement in jump performance and strength in the players than the traditional strength training.

In another study conducted by Cochrane et. al in 2004, 24 sport science students (16 men and 8 women) were divided in to 2 groups. One group received whole body vibration training for 9 days while the other group was the control group. Contermovement jump height, squat jump height, sprint speed over 5, 10 and 20 m and agility (505, up and back) were reported before and after training. Result showed no significant difference between training group and the control group for counter movement jump, squat jump, sprint and agility.

C J de Ruiter et al conducted a study in 2003 in which 20 subjects were divided equally in to an experimental and a control group, in experimental group, training was given 3 times a week, they were made to stand barefoot with a 110 knee flexion angle on vibration platform for a total of 11 weeks of training. control group followed the same procedure but did not stand on the vibration platform. Countermovement jump height and functional knee extensor muscle strength were measured pre and post training. Result showed that counter movement jump height was unaffected by the whole body vibration. Also, the muscle strength did not improve.

In a study conducted by Shiuan- Yu Tseng in 2015, 45 elderly subjects were divided in to 3 groups. One group underwent whole body vibration training with eyes open, 2nd group received visual feedback deprived whole body vibration training and the 3rd group was the control group. The training was given for 3 months , 3 times a week for 5 minutes on each session. Limits of stability test was used for balance assessment and the isokinetic dynamometer was used for muscle strength assessment. Results showed that visual feedback deficient group had the greatest improvement in both the balance and the strength than the other 2 groups.

Torvinen SP, Kannus et al conducted a study in 2002 in which 56 voluntanteers were randomly divided in to 2 groups- one is whole body vibration group undergoing intervention for 4 months and the other one was the control group. Vertical jump, isometric extension strength of lower extremity, grip strength, shuttle run and postural sway were measured. Results showed that jumping power was improved in the whole body vibration group than the control group. However, no effect of whole body vibration was found on the static and dynamic balance.

Discussion

However, few studies have been done on the effect of whole body vibration on performance, the results of some of the studies reveal positive effect of WBV on vertical jump height, balance and strength while some studies on the other hand proves no effect of whole body vibration on these parameters.

Perez Tupin JA et al proved the efficacy of whole body vibration in improving vertical jump performance and strength in volleyball players when compared to the traditional strength training.

Another study conducted by Torvinen SP kannus et al supported the findings of Perez Tupin JA. He concluded that jumping power and height was improved by whole body vibration.

However a study conducted by Cochraine et al showed no effect of whole body vibration on counter movement jump height and squat jump. Similarly, CJ de Ruiter concluded in his study that countermovement jump height as well as the lower extremity muscle strength was not improved with whole body vibration.

As some studies proved efficacy while the others rejected its effectiveness in jump height, further study is required in this direction.

Shiuan – Yu Tseng proved that whole body vibration along with the removal of visual feedback is s very effective tool in improving balance and strength.

However, another study by Torvinen SP Kannus revealed no beneficial effect of whole body vibration on static and dynamic balance.

Whole body vibration works by transferring energy to human body through an oscillatory platform which facilitates the tonic vibration reflex through monosynaptic and polysynaptic pathways and the stimulation of the reflex involuntary muscle contractions.

A further research on the efficacy of whole body vibration on jump height and balance is needed as there are few studies supporting its effectiveness and some rejecting it. Studies should also be conducted comparing the effects of different parameters of whole body vibration on vertical jump height and performance.

Conclusion

Whole body vibration can be used as a training modality in improving vertical jump performance, balance and strength of lower extremity but further study is recommended. Whole body vibration without visual feedback was found superior to the only whole body vibration in improving balance.

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