

THE EFFECT OF WHOLE-BODY VIBRATION
(WBV) DURING THE INTER-SET REST PERIOD ON
RATE OF MUSCLE ACTIVATION DURING
STRENGTH TRAINING EXERCISE

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ABSTRACT

The main aim of this study is to investigate neural effect of using whole-body vibration (WBV) modality, as a non-fatiguing training stimulus (active recovery), metabolic performance (blood lactate) and heart rate responses during the inter-set rest period of hypertrophy based loading. Second to this, comparisons were also made between WBV effects versus traditionally use passive recovery method. Eight recreationally trained men were recruited for this study. Subjects randomly attended to testing sessions, where WBV modality was used during the inter-set rest period in one session and passive standing recovery was used in another session. In both sessions, subjects performed three sets of 10 repetition of squat exercise at 70% 1RM with 2 minutes inter-set rest period. Quadriceps and hamstring in-vivo muscle activation were assessed during the squat performance. The result of this study indicated that no significant differences were found between WBV active recoveries versus non-WBV passive recoveries in term of rate of muscle activation, blood lactate collection and heart rate responses. Thus, while WBV has been commercially promoted as an effective training tools, its effectiveness as an inter-set strength training active recovery tools was equivocal questionable. WBV application during the inter-set rest period did not promote muscle neural drive and it was similar with passive recovery in terms of muscle activation as it did not provide any additional stimulus that was expected. However, WBV as an inter-set recovery modality can be used as an alternative to passive recovery modality.





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ABSTRAK

Tujuan utama kajian ini adalah untuk mengkaji kesan neural penggunaan modaliti latihan getaran seluruh badan (WBV) sebagai rangsangan pemulihan aktif, yang tidak melemahkan prestasi metabolik (darah laktik) dan tindak balas kadar denyutan jantung, semasa tempoh rehat antara set berdasarkan parameter bebanan hipertropi. Perbandingan juga dibuat antara kesan WBV berbanding kaedah pemulihan pasif. Lapan orang lelaki separa terlatih telah direkrut secara sukarela untuk kajian ini. Subjek secara rawak menghadiri dua sesi ujian, dimana modaliti WBV telah digunakan semasa tempoh rehat antara set dalam satu sesi, dan pemulihan kedudukan pasif telah digunakan pada sesi yang lain. Dalam kedua-dua sesi, subjek melakukan senaman mencangkung sebanyak 3 set dengan 10 ulangan pada 70% 1RM, dengan 2 minit tempoh rehat antara set. Kadar pengaktifan otot peha dinilai semasa lakuan senaman mencangkung. Hasil kajian ini menunjukkan tiada perbezaan yang signifikan didapati antara penggunaan pemulihan aktif WBV berbanding pemulihan pasif bukan WBV dari segi kadar pengaktifan otot, penghasilan darah laktik dan tindak balas kadar jantung. Oleh itu, walaupun WBV secara komersilnya digalakkan sebagai alat latihan yang berkesan, penggunaannya sebagai modaliti rehat aktif antara set dalam latihan kekuatan boleh diragui. Penggunaan WBV semasa tempoh rehat antara set tidak menggalakkan rangsangan otot menunjukkan bahawa ia tidak memberi apa-apa rangsangan tambahan untuk dipraktikkan. WBV sebagai modaliti pemulihan aktif antara set boleh digunakan sebagai alternatif kepada pemulihan pasif, tetapi mungkin manfaat tambahan dalam rangsangan latihan masih boleh dipersoalkan.





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CHAPTER 1

INTRODUCTION



1.1 Background of Study

Whole body vibration or also known as WBV has gain a lot of attention for strength development within the sports and exercise science fraternity over the past few years. Studies have been conducted on the effectiveness of using WBV as a strength training tools in many different set-up such as sports performance (Cochrane, Legg & Hooker, 2004; Torvinen et al., 2002), rehabilitation (Bruyere et al., 2005), and general fitness for untrained population (Roelants, Delecluse, Goris & Verschueren S., 2004).

In term of performance, whole body vibration has been found to be effective in developing strength and power (Cormie et al., 2006) improving agility and quickness (Cochrane, Legg & Hooker, 2004) improving balance (Torvinen et al.,





2002) and increased leg muscle activity (Roelants et al., 2006). However, none of these studies have used whole body vibration as recovery modalities.

Studies on active recovery using other modalities or exercises during strength training session has indicated that active recovery is useful in a manner that it will improves blood lactate clearance rate or lactate metabolism (Bangsbo et al., 1994; Corder et al., 2010 and Martin et al., 1998), improves power output (Bogdanis et al., 1996 and Connolly, Brennan & Lauzon, 2003) and increased amount of work performed (Spierer et al. 2004).

Previous study has found that metabolic power in whole body vibration can be parametrically controlled by frequency and amplitude, and by application of additional load; with muscle activities might directly be influenced by these (Rittweger et al., 2002). While many studies have investigated appropriate frequency and amplitude of WBV application for work period exercise performance (Adams et al., 2009; Cardinale & Lim 2003; Gerodimos et al. 2010; Turner et al., 2011), as far as the researcher's knowledge, none has ever investigated and published appropriate frequency and amplitude for inter-set rest and recovery during strength training session. However, Armstrong et al., did performed a study looking into the possibilities of using WBV as a warm-up tools, in which they concluded that WBV have only a small window of effectiveness as a warm-up tools (Armstrong et al., 2010).

Results of previous studies has also indicated that not all physical training aiming for peak performance will gain benefits that have a significance results



compared to conventional strength training (Jones et al., 2011) . Due to this, questions arise whether the WBV for peak performance might be more suitable to be used in combination with conventional strength training program, such as by implementing it during the inter-set rest period.

Electromyography (EMG) assessment typically use in determining muscle recruitment pattern, and in assessing overall muscle activity during certain strength training exercise and session (Isear et al., 1997). EMG signal amplitude and rate of EMG rise also indicate rate of neural drive involvement in muscle contraction during strength training exercises (Aagaard et al., 2002). It is a common knowledge that strength improvement during the earlier phase of strength training program is due to the improvement in neural adaptation, rather than changes in cross-sectional area of muscle fibers (Bandy et al., 1990; Behm 1995; Bradenburg & Docherty 2002).

As a conclusion, it had been the main aim of this study to investigate the possibilities of retaining muscle activities during each sets of squat exercise in a strength training session, by using WBV during the inter-set rest period as the active-recovery tools.

1.2 Significance of Study

The use of whole body vibration as training modalities during exercise is common nowadays. However, the possibility of using WBV as another alternative mode of



active recovery is still unexplored, and thus this study is significance due to this reason.

1.3 Problem Statement

The rationale behind this is that a component of training period consists of work and rest period. If the work period performance can be maintained or improved, overall adaptations longitudinally might be increased. At present, most of the studies are focusing on vibration as training tools, thus provide more findings for the work period, in which studies on the rest period during training seems to be neglected. More research during the rest period is needed in order to give balance to the overall body of knowledge regarding a good quality of training period.

There are many factors involved that indicate the work period exercise performance during strength training. One of it is the rate of activities produces by each muscle group. By monitoring muscle activity level, one can accurately see whether the in-between set recovery is actually contributing or not, in ensuring optimal performance for each sets performed, during the strength training exercise (in example squat exercise).





As a conclusion, this study provided the foundational basis for other further studies in future for the use of WBV as a recovery tool, instead of its current usage limited to training and rehabilitation of injury.

1.4 Purpose of Study

The purpose of this research was to investigate the effect of having whole body vibration as an active recovery modality as opposed to typically used passive recovery during the inter-set rest period on squat exercise in neural performance (muscle activity), metabolic performance (blood lactate) and heart rate responses.



This study was addressed to these hypotheses:

- a) H₀: There is no significant difference in squat exercise in-vivo rectus femoris and biceps femoris muscle activation rate on WBV exposure during inter-set rest period.

H₁: There is significant difference in squat exercise in-vivo rectus femoris and biceps femoris muscle activation rate on WBV exposure during inter-set rest period.





- b) HO: There is no significant difference in squat exercise in-vivo rectus femoris and biceps femoris muscle activation rate on non-WBV exposure during inter-set rest period.

HI: There is significant difference in squat exercise in-vivo rectus femoris and biceps femoris muscle activation rate on non-WBV exposure during inter-set rest period.

- c) HO: There is no significant difference in squat exercise in-vivo rectus femoris and biceps femoris muscle activation rate on WBV exposure and non-WBV exposure during inter-set rest period.



HI: There is significant difference in squat exercise in-vivo rectus femoris and biceps femoris muscle activation rate on WBV exposure and non-WBV exposure during inter-set rest period.

- d) HO: There is no significant difference in squat exercise in-vivo metabolic performance in WBV exposure and non-WBV exposure.

HI: There is significant difference in squat exercise in-vivo metabolic performance in WBV exposure and non-WBV exposure.

- e) HO: There is no significant difference in squat exercise in-vivo heart rate on WBV exposure and non-WBV exposure.





HI: There is significant difference in squat exercise in-vivo heart rate on WBV exposure and non-WBV exposure.

1.6 Limitations and Delimitations of The Study

a) Limitations

Subjects asked to have similar dietary intake on all testing and training days. However subjects' typical daily nutritional intakes were not controlled. It was also beyond the researcher's capabilities to control subjects' daily physical activities, as some activities may unduly influence the training of the involved muscle groups of interest.

b) Delimitations

The findings of this study was delimited to males, aged between 23 to 33 years old, with no lower limb and spine injury record for the past 2 years, have no implant or foreign bodies and have a strength training background of at least 6 months. Thus, the results of this research were not being applicable to other groups of people with different characteristics.