Effect of Whole Body Vibration Training on Cardiovascular Disease Risk Factors in Inactive Adults

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Abstract: The purpose of the present study was to determine the effect of whole body vibration training with a 1-month intervention period and 3-month no intervention follow up on cardiovascular diseases risk factors in inactive adults. Eleven inactive adults (age 47.45±6.05 years, height 160.24±9.63 cm and body mass 72.42±6.98 kg) were randomly chosen and took part in the study. Vibration training included 11-17 minutes of different positioning in frequency of 25-35 Hz, done once a day for 30 sessions. Concentration of fasting blood sugar, total cholesterol, triglyceride, HDL and LDL were measured at three different intervals (baseline, immediately after 1 month, after three months detraining). One-way repeated-measures analysis of variance and Bonferroni-corrected paired t-tests were used to test for differences between the three intervals. Significance was set at p = 0.05. The results showed that significant difference was detected in concentration of Fasting blood sugar (p=0.000), total cholesterol (p=0.050) and LDL-C (P=0.050) between three intervals. In contrast no significant difference was observed in concentration of triglyceride (p=0.818) and HDL-C (p=0.293) between all measured time units. In summary, triglyceride and HDL-C did not change significantly during the study period and follow-up, but there was a significant decrease of concentration of Fasting blood sugar, total cholesterol and LDL-C after 1 month compared to baseline. These data suggest that Whole body vibration training may have the potential to reduce cardiovascular diseases risk factors in inactive adults, thus inactive adults lacking stamina for doing exercise can be put for vibration training as an effective substitute.

Key words: Cardiovascular Diseases Risk Factors • Inactive Adults • Whole Body Vibration Training

INTRODUCTION

Cardiovascular diseases are the leading cause of mortality and disability throughout the world [1,2]. About 17 million people die annually as a consequence of cardiovascular diseases [3]. In Iran the prevalence of cardiovascular diseases risk factors is high [4] and in contrast to trends observed in northern Europe and the USA recent data show that mortality from cardiovascular diseases is increasing in Iran [5]. Many mechanisms contribute to cardiovascular diseases and each of these mechanisms has specific risk factors, if any of these risk factors exceed the normal range, the possibility of cardiovascular diseases increases. Important risk factors of cardiovascular disease include increased total cholesterol, triglyceride, LDL cholesterol (LDL-C), Fasting blood sugar, systolic and diastolic blood pressures and decreased HDL cholesterol [6, 7]. There is evidence showing the beneficial effects of physical exercise on all the factors in adults [8]. Despite the proven benefits of physical activity, more than 50% of adults do not get enough physical activity to provide health benefits [9]. Recent findings emphasize that whole body vibration training may provide a way of training for peoples who are less willing to participate in exercise classes in gyms, or ones who have difficulty in walking [10]. Since the WBVT done while standing on the Vibration platform, it reduces the probability of risk for injuries such as falling and stress fracture associated with other exercises; and it has received a great deal of

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attention due to reports of enhanced physical performance [11]. According to the research studies there was strong relationship between physical activity and cardiovascular diseases risk factors [7], but this relationship is not clear about Whole body vibration training. Further, WBVT is a new training program that is safe and non-expensive. Thus, The purpose of the present study was to determine the effect of whole body vibration training with a 1-month intervention period and 3-month no intervention follow up on cardiovascular risk factors in inactive adults.

**MATERIALS AND METHODS**

Eleven (9 women, 2 men) inactive adults (age 47.45±6.05 years; height 160.24±9.63 cm and body mass 72.42±6.98 kg, mean±SD) participated voluntarily in this study. All subjects were physically healthy but were not involved in a regular exercise program. None of the subjects had any previous experience with WBV training. They were informed about the experimental procedure and their written informed consent was obtained. All measurements were performed in the morning. Body mass was measured to the nearest 0.1 kg with light clothes on, using an electro digital scale seca (alpha Hamburg, Germany). Height was measured in centimeters to the nearest 0.1 cm in standing position with socks and shoes removed, using a digital stadiometer and body mass index was calculated as weight in kg over height in m².

A fasting blood sample was taken from antecubital vein between 8:00 and 9:00 AM to determine fasting levels of lipids and glucose at three different intervals before (baseline), immediately after 1-month training and after three months detraining. All blood lipid analyses were done at the Sepidan laboratory. The analysis of samples was performed using a Selectra 2 auto-analyser (Vital Scientific, Spankeren, Netherlands). Total cholesterol and triglyceride kits (Pars Azmoon, Islamic Republic of Iran) were used. Fasting blood sugar (FBS), total cholesterol (TC) and triglycerides (TG) levels were assayed using enzymatic colorimetric tests with glucose oxidase, cholesterol oxidase and glycerol phosphate oxidase respectively. High-density lipoprotein cholesterol (HDL-C) was measured with phosphotungstic acid. Low-density lipoprotein cholesterol (LDL-C) was calculated from serum TC, TG and HDL-C using the Friedwald formula (12). The subjects performed 30 session of static and dynamic leg and arm exercises (high squat, deep squat, biceps curl,...) on a vibration platform (Nemes-LB Bosco System), one session per day. The frequency of the vibration stimulus varied between 25 to 35Hz the total duration of vibration in one session varied between 11 to 17 minutes (Table1).

**RESULTS**

Body mass was decreased significantly after 1 month whole body vibration training compared to body mass in baseline (72.47±6.98kg vs. 69.85±7.03kg p=0.000). Concentration of triglyceride (p=0.818) and HDL-C (p=0.293) did not change significantly during the study period and follow-up. In contrast significant difference was detected in concentration of Fasting blood sugar (p=0.000), total cholesterol (p=0.050) and LDL-C (P=0.050) between three intervals. After one month whole body vibration training fasting blood sugar, total cholesterol and LDL decreased significantly and again increased after 3 months detraining (Table2).

**Table 2: Cardiovascular diseases risk factor at three different intervals**

<table>
<thead>
<tr>
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<th>Baseline</th>
<th>One month</th>
<th>Three months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Blood Sugar</td>
<td>98.55±7.66</td>
<td>89.66±6.55</td>
<td>97±7.71</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>62.79±140.87</td>
<td>61.30±134.5</td>
<td>43.07±147.25</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>193.33±36.04</td>
<td>26.77±171.55</td>
<td>38.07±179.55</td>
</tr>
<tr>
<td>LDL</td>
<td>35.82±123.22</td>
<td>32.39±104.22</td>
<td>34.99±105.55</td>
</tr>
<tr>
<td>HDL</td>
<td>2.96±42.55</td>
<td>2.44±40.66</td>
<td>2.47±41.11</td>
</tr>
</tbody>
</table>

Data are expressed as mean±SD. Normality of distribution was verified with a Kolmogorov-Smirnov test. One-way repeated measures analysis of variance and bonferroni- corrected paired t-tests were used to test for differences between the three intervals. Significance level was set at p<0.05.
DISCUSSION AND CONCLUSION

The major finding of this study reached that whole body vibration training improved cardiovascular risk factors in inactive adults. Similar to our study, Moussavi et al. [17] have reported that WBVT had positive effect on cardiovascular disease risk factors in academic students. The underlying mechanism by which WBV can have an effect on cardiovascular diseases risk factors remains unclear. However, there were some possible contributing factors. Whole body vibration training has proposed to increase energy expenditure via repetitive muscle contractions [9]. Furthermore WBV stimuli increased serum free fatty acid concentration during the recovery period and acute exposure to WBV activates the central sympathetic nervous system (SNS) that one key role of the SNS innervation of white adipose tissue is to trigger lipolysis. There was an association between a low SNS activity and a low lipid oxidation and a low SNS activity is a risk factor for weight gain in humans [13]. Interestingly, Rubin et al. [14] reported that adipogenesis is inhibited in mice by brief, daily exposure to low-magnitude mechanical signals, delivered via WBV [14]. When trying to explain the effects of WBV, it should be noted that WBV may elicit secondary responses through interaction among different systems: the skeletal, muscular, endocrine, nervous and vascular systems [15].

In brief, these data suggested that Whole body vibration training may have the potential to reduce cardiovascular risk factors in inactive adults and as vibration training is a strategy in eliciting muscular contraction, inactive adults lacking stamina for doing exercise can opt for vibration training as an effective substitute.

REFERENCES
