Acute Effect of Whole Body Vibration Versus Resistance Exercises in Hypertension Patients

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ABSTRACT

Background and Objective: The purpose of the study was to compare the acute effect of whole body vibration (WBV) to acute effect of resistance exercise on blood pressure in patients with hypertension. **Methods:** fifty patients (24 males and 26 females) were selected of both sexes and their age were ranged from 40 to 50 years old selected from Beni-seuf Health Insurance Hospital and they were assigned into two equal groups: **Group (A)** Twenty-five patients had performed WBV exercise &**Group (B)** Twenty-five patients performed resistance exercise. The duration of each method was 25 minutes performed for one session. Systolic blood pressure and Diastolic blood pressure were measured before and after the program. **Results:** In Group (A) when post treatment results compared with pre-treatment results there was a significant decrease in SBP and DBP by 3.32%and 7.41%, respectively. In Group (B) when post treatment results compared with pre-treatment results there was a significant decrease in SBP and DBP by 2.50%and 6.24%, respectively. In addition, Group A results versus Group B results there was significant difference in mean values of SBP&DBP. **Conclusion:** in this study acute effect of WBV is more effective than did the resistive exercise in reducing blood pressure in hypertensive patients.

Keywords: Diastolic blood pressure, Resistance exercise, Systolic blood pressure and Whole Body Vibration.

INTRODUCTION

American Heart Association updated the classification of hypertension as Normal blood pressure systole <120 mm Hg and diastole <80 mm Hg Elevated blood pressure systole 120–129 mm Hg and diastole <80 mm Hg Hypertension Stage 1 systole 130–139 mm Hg or diastole 80–89 mm Hg Stage 2 systole ≥140 mm Hg or diastole ≥90 mm Hg [1].

Hypertension is one of the major risk factors for cardiovascular morbidity. Hypertension worldwide prevalence has been estimated to be over one billion and treatment costs are substantial. Regular participation in training program (continuous walking, jogging and cycling) has been shown to reduce blood pressure and ambulatory blood pressure of hypertensive individuals and promotes general health and improvement in cardiovascular risk factors [2].

Hypertension is one of the nine leading risk factors influencing the global burden of cardiovascular disease. It is estimated to lead to seven million deaths each year that is about 13% of the total death worldwide. Hypertension is a major modifiable risk factor for cardiovascular disease. Elevated blood pressure levels have been shown to be a risk factor for stroke, congestive heart failure, myocardial infarction, peripheral vascular disease and end-stage renal disease [3].

Whole-body vibration (WBV) is an alternative exercise modality for improvements in muscle strength which involves exercising on a vibrating platform that stimulates reflexive muscle contractions. Compared with conventional resistance training, WBV training requires less time and provides similar increases in leg strength, indicating that WBV training is an efficient strength training method [4].

Whole-body vibration which causes an increase in muscle perfusion to the lower extremities may acutely as well as chronically result in a decrease in arterial stiffness, which should induce a BP-lowering effect following exercise [5].

Resistance exercise is a type of exercise in which all movements are made against an imposed force. One of its advantages is prevention of muscles' mass atrophy and their decreased function. Contrary to aerobic exercises, resistance exercises involve more muscle mass during a period of exercises and increases the ability among the patients with coronary artery diseases to do their everyday activities through improvement or preservation of muscular power and reduction of blood pressure (BP) by increase of resting metabolism and weight loss. [6].

Dynamic resistance exercises can lower BP by a modest degree, especially in stage 1 hypertension, with no evidence of harm, acute triggering of cardiovascular events during exercise, or chronic worsening of BP [7].

The purpose of the study was to compare the acute effect of whole body vibration to acute effect of resistance exercise on blood pressure in patients with hypertension.

MATERIALS AND METHODS

Fifty patients from both sexes 24 men and 26 women diagnosed as hypertension and tested for one session and the study was conducted at department of physical therapy at Beni- Seuf health insurance hospital.

Inclusion criteria:

- Their age ranged from 40- 50 years' old
- Non smoker
- Sedentary life <90 minutes of regular exercise per week
- BMI ranged between 25-29.9 Kg/m2.
- Each patient of both groups continued to take their usual medication as prescribed by physician.
- Essential hypertension.

Exclusion criteria:

- Disease that interfere with dynamic resistance exercise or WBV as active gout or severe osteoarthritis
- Diabetic neuropathy disease
- Unstable cardiovascular and pulmonary disease
- Renal failure disease.
- Recent surgery.
- Secondary Hypertension

Design of study: fifty patients was assigned randomly into 2 equal groups: - Group (A) Consisted of twenty-five patients performed whole Body Vibration on (crazyvit exercise machine) divided into (11 men and 14 women) for one session program. Group (B) Consisted of twenty-five patients performed resistance exercises using body bar divided into (13 men and 12 women) for one session program.

Ethical committee: After obtaining approval of The Research Committee at faculty of Physical therapy Cairo university and Beni-seuf Health Insurance Hospital, all patients signed informed consent for the purpose and nature of the study. Approved this study (24/6/2018).

Procedure: A complete explanation, past history taken and medical examination have been collected before the program started**.**

Evaluation process: The evaluation procedure had been done for both group patients.

1. Weight and height scale 2. Systolic and diastolic blood pressure measurement by Automatic blood pressure monitor Omron M3W (HEM-7202-E) before and after training 3. Time of the session measured by device watch.4. One repetition maximum (1 RM) for group (B).

Treatment process:

The program of the study had given 2 equal groups (A and B) for one session training.

Group (A): training used WBV. The program was subdivided into 3 phases, the warm up phase for 5 minutes in form of light stretching exercises, the main exercise phase 15 minutes of 6 sets of 10 repetitions of squat exercise with 30 seconds rest between sets on vibration platform with intensity of 35 Hz and 5–6mm amplitude and third phase was the cool down phase for 5 minutes in form of light stretching exercises.

Group (B): training used body bar. The program was subdivided into 3 phases, the warm up phase for 5 minutes in form of light stretching exercises, and the main exercise phase 15 minutes of 6 sets of dynamic squat on the floor of 10 repetitions with 30 seconds rest between sets at an intensity 20% of 1 repetition maximum(1RM) and third phase was the cool down phase for 5 minutes in form of light stretching exercises.

Data analysis:

The statistical analysis was conducted by using statistical SPSS Package program version 20 for Windows (SPSS, Inc., Chicago, IL).

- Descriptive statistics including the mean and standard deviation for age, BMI, systole blood pressure and diastole blood pressure variables.
- Paired t-test to compare between pre and post-treatment within each group for systole blood pressure and diastole blood pressure variables.
- Unpaired (Independent) t-test to compare between study and control groups for age, BMI, systole blood pressure and diastole blood pressure variables.
- Significant level all statistical analyses are significant at level of probability 0.05 ($P \leq 0.05$).

Results

1. Physical characteristics

Table (1) represented the comparative of physical characteristic values between resisted and WBV groups. The statistical analysis by independent t-test revealed that no significant differences (P > 0.05) in values of physical characteristics (age and BMI) between resisted and WBV groups.

Table (1): Comparison of physical characteristics mean values between resisted and WBW groups.

Items	Age (year)	BMI (kg/m^2)
Resisted group	46.43 ±3.73	27.53 ±1.47
WBV group	45.50 ±3.85	27.37 ±1.47
t-value	0.953	0.437
P-value	0.345	0.664
Significance	NS	NS

SD: standard deviation P-value: probability value NS: non-significant.

Table (2) represent sex distribution between resisted and WBV groups. Sex distribution between resisted and WBV groups revealed that numbers (percentage) of male were 13 (52.0%) and 11 (44.0%), numbers (percentage) of female were 12 (48.0%) and 14 (56.0%), respectively. The statistical analysis by Chi square test (χ^2-test) revealed that there was no significant difference (P=0.835; P>0.05) in sex distribution between resisted and WBV groups.

Table (2): Comparison of sex distribution between resisted and WBW groups.

Items	Sex	
	Male	**Female**
Resisted group	13 (52.0%)	12 (48.0%)
WBV group	11 (44.0%)	14 (56.0%)
Chi-square value	0.052	
P-value	0.835	
Significance	NS	

SD: standard deviation P-value: probability value NS: non-significant.

2. Systole blood pressure:

2.1. Within groups

Table (3) represented the comparative mean values between pre- and post-systole blood pressure within each group. The statistical analysis by paired t-test revealed that there were significant differences between pre- and post-systole blood pressure within group A &B.

Table (3): Comparison between mean values of pre- and post-systole blood pressure within each group.

Items	Systole blood pressure	
	Resisted group (Mean ±SD)	**WBV group (Mean ±SD)**
Pre-treatment	129.47 ±5.823	130.97 ±5.37
Post-treatment	125.17 ±4.893	121.27 ±5.85
Mean difference	4.30	9.70
Improvement %	3.32%	7.41%
t-value	8.873	28.568
P-value	0.0001	0.0001
Significance (P<0.05)	S	S

SD: standard deviation %: percentage P-value: probability
S: significant

2. Between groups

Table (4) represented the comparative mean values of pre- and post-systole blood pressure between resisted and WBV groups. The statistical analysis by independent t-test revealed that there was no significant difference in pre-systole blood pressure (P=0.304; P>0.05) while, a significant difference in post-systole blood pressure (P=0.007; P<0.05) between resisted and WBV group.

Table (4): Comparison mean values of pre- and post-systole blood pressure between both groups.

Items	Systole blood pressure	
	Pre-treatment (Mean ±SD)	**Post-treatment (Mean ±SD)**
Resisted group	129.47 ±5.823	125.17 ±4.893
WBV group	130.97 ±5.37	121.27 ±5.85
Mean difference	1.50	3.90
t-value	1.037	2.800
P-value (P<0.05)	0.304	0.007
Significance	NS	S

SD: standard deviation %: percentage P-value: probability S: significant
NS: non-significant

3. Diastole blood pressure:

3.1. Within groups

Table (5) represented the comparative mean values between pre- and post-diastole blood pressure within each group. The statistical analysis by paired t-test revealed that there were significant differences between pre- and post-diastole blood pressure within resisted group (P=0.0001; P<0.05) and WBV group (P=0.0001; P<0.05).

Table (5): Comparison between mean values of pre- and post-diastole blood pressure within each group.

Items	Diastole blood pressure	
	Resisted group (Mean ±SD)	**WBV group (Mean ±SD)**
Pre-treatment	84.00 ±2.94	84.77 ±3.00
Post-treatment	81.90 ±3.31	79.48 ±2.98
Mean difference	2.10	5.29
Improvement %	2.50%	6.24%
t-value	5.659	14.837
P-value	0.0001	0.0001
Significance (P<0.05)	S	S

SD: standard deviation %: percentage P-value: probability
S: significant

3.2. Between groups

Table (6) represented the comparative mean values of pre- and post-diastole blood pressure between resisted and WBV groups. The statistical analysis by independent t-test revealed that there was no significant difference in pre-diastole blood pressure (P=0.302; P>0.05) while, a significant difference in post-diastole blood pressure (P=0.004; P<0.05) between resisted and WBV group.

Table (6): Comparison mean values of pre- and post-diastole blood pressure between both groups.

Items	Diastole blood pressure	
	Pre-treatment (Mean ±SD)	**Post-treatment (Mean ±SD)**
Resisted group	84.00 ±2.94	81.90 ±3.31
WBV group	84.77 ±3.00	79.48 ±2.98
Mean difference	0.77	2.42
t-value	1.042	2.971
P-value (P<0.05)	0.302	0.004
Significance	NS	S

SD: standard deviation %: percentage P-value: probability S: significant
NS: non-significant

DISCUSSION

Although results of both whole body vibration group and resisted group showed statistically significant difference in reduction of systolic and diastolic blood pressure, but whole body vibration group showed more significant improvement in mean difference that it can be used as a management tool for hypertensive patients.

Our results agreed with Morais et al., (2011) [8] who reported that SBP and DBP were decreased over a 24 h period in resisted group more than the aerobic group after single bout of resisted training at 70% 1RM while in this study we used 20%of 1RM.

Márcio et al. (2013) [9] found reduction in SBP and DBP rest values after the acute sessions of RT program .PEH (last for 1 hour) was observed only for the experimental group , while no change was found in control group.

Also, the current study comes in line with the result of another study by Alexei et al., (2016) [4]that showed significant decrease in SBP and DBP measures after the WBV training program of 2 5- 40 HZ for 8 weeks in exercising group rather than no change in non exercising group .

Also Arturo et al. (2012) [10]stated that WBV significantly decreased SBP and DBP in tested group rather than control one when using 25HZ for 6 weeks in normotensive overweight/obese women

Konstantina et al. (2016) [11] recorded that BP values not reduced during exercise or recovery period following one session of WBV training of 25 HZ but SBP&DBP were augmented from baseline in obese women more than lean.

Mahnoosh et al. (2014) [12] reported that there were no significant changes in SBP, DBP or in heart rate values in their study which included 9 inactive women trained on WBV in frequency of 35HZ for a month.

Zachary et al .,(2016) [5]recorded that Compared with RE alone, a single bout of WBV with RE resulted in a greater post exercise hypotension response which measured every 15 minutes for 3 hours. systolic BP was significantly lower for WBV with RE as compared with RE or CON, while diastolic BP was lower for both WBV with RE and RE compared with control group.

Conclusion:

In conclusion, results of the current study SBP and DBP that were tested in the group (A) decreased when compared the pre and post exercise results and also in the group (B) showed a decrease in the results when compared pre and post exercise results. But when the results of the group (A) compared versus to the group (B), results showed that there were more significant reduction in SBP and DBP values in group (A)them and this concluded that both of WBV and resistance exercise can be used as a treatment tool to hypertension but WBV is consider a more effective tool.

We recommend further investigation on chronic effect of both these types of exercises on hypertension and also we recommend study the effect of WBV and resistance exercises against control group,

also test a larger number of patients in each group and further investigation on effect on both sex.

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