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The Effects of Gymnastics and Whole Body Vibration Exercises on Body Composition

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Abstract

The purpose of this study was to comparatively analyze the effects of 6 weeks of gymnastics and whole body vibration exercises on body composition. Twenty twomale subjects participated in this research (Age average 21.4 ± 2.4 and height average1.75 ± 5.6 cm).Participants were randomlyassigned to three groups;Gymnastics and Whole-body Vibration Exercise Group (GWBVEG, n=7), Gymnastics ExerciseGroup (GEG, n=8) and Control Group (CG, n=7).Body composition were measured before and after 6 week-exercise period.For data analyses Wilcoxon Signed Ranks Test was used in order to look at the differences among the dependant groups and Mann Whitney Utest was used in order to to look at the differences among the independant groups.When the groups' post-tests forbody composition values were compared, it was observed that the improvement of body composition (Impedance (IMP) values of the GWBVEG group was significantly higher than the one for GEG and CG groups($p>0.05$). As a result, it is suggested that the whole-body vibration in gymnastics can be considered as an important criteria for the improvement of body composition.

Keywords: Whole Body Vibration, Gymnastics, Body Composition

Introduction

Vibration exercises are used as a performance improvement method in sports and exercise sciences, especially after the year of 2000. It attracted the attention of researchers as a special exercise and workout method (Show, C. C. 2005; Power Plate

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Next Generation 2016). Therefore, vibration exercises are currently part of many sports centers' programsas a popular exercise type.

The effect of vibration exercise or of itstraining depends on the characteristics of the vibration (Kin İşler, A. 2007).Vibration is used in two different methods as an exercise anda training method.The first method is called "local vibration" practice.In this method, the vibration can be applied directly on the widest surface of the muscle needed for workout or on the tendon.Moreover, it can be applied by a hand-held vibration source. In the second method, which is called "whole-body vibration (WBV)", the vibration is applied by a vibration source, which is away from the target muscle (Demirel, N.et al., 2009; Demirel, N. 2009; Hannah, R. et al., 2013). The importance of vibration exercises is the fact that they causeinvoluntary consecutive muscle contractions.These movements taking place in muscles cause tension in the tendons as well.This tension also helps beneath-abdominal muscleswhich are called "deep muscles", spinal muscles and facial muscles work. Therefore, vibration exercises strengthen the muscles by working them deeplyin short periods of time (Bosco, C. et al., 1999).

Therefore, the purpose of this research is to comparatively analyze whether gymnastics exercises combined with whole body vibration exercises have an effect on body composition.

Material And Method

Participants

Twenty twountrained male college students who enrolled in Physical Education and Sports programparticipated in this research. Average age of the subjects was 21.4 ± 2.4 years and average height was 1.75 ± 5.6 cm.Participants were randomly assigned to three groups; gymnastics and whole-body vibration exercise group (GWBVEG, n=7), gymnastics exercise group (GEG, n=8), control group (CG, n=7).There were no significantdifferencesamong the groups'baseline values of body compositions($p>0.05$).

To be eligible to participate in the study, subjects were required to meet the following criteria:

Participants' age ranging between 20-25 years old. Participants not involving in any sport activities except for gymnastics class in their degree program. Participants not being involved in any vibration and strength training for the targeted muscles during the six-month period prior to starting the exercise. Participants not having any medical obstacle to use the vibrations-work-out tool or any back problems. Written informed consent was obtained from all subjects after they had received a full explanation of the study procedures. Subjects did not change their usual daily activity during the period of the study. The study was performed in accordance with the

Helsinki Declaration of 1975, and was approved by the Ethical Committee of the University.

Procedures

Study design: In this study, "pre-test, post-test controlled group "model was used. After the pre-test, the subjects in the GWBVEG and GEG groups performed six-weeks of exercise training (Table 1), while the CG did not participate in any exercise training. During the training, all subjects were under direct supervision and were instructed on how to perform each exercise.A Power-Plate vibration platform (Pro 5, USA) was used to superimpose WBV on voluntary exercise.)

Table 1 : Exercise Protocol

Groups	Exercise	Interval Andintensty Period	
CWBVEG	•Calves •Deep Squat •Lunge (Right) •Lunge (Left) •Lateral Abdominals (Right) •Lateral Abdominals (Left) •Abdominal Crunch •Push Up •Triceps Dip •Hamstring Stretch	1 x 60	35 Hz - Low / High
GEG GRUBU	•Calves •Deep Squat •Lunge (Right) •Lunge (Left) •Lateral Abdominals (Right) •Lateral Abdominals (Left) •Abdominal Crunch •Push Up •Triceps Dip •Hamstring Stretch	1 x 60	Body Weight
CG	-		

	GWBVEG(n=8)	GEG(n=7)	CG(n=8)				
	Pre test	**Post test**	**Pre test**	**Post test**	**Pre test**	**Post test**	
BIA VALUES							
Body Mass (BM) Kg	X (SD)	68.4 10.29	66.8 9.9	67.9 9.6	66.0 8.6	64.49 6.1	63.9 5.6
	Z	**2.371***	**2.521***	1.859			
Body Mass Index (BMI) Kg/m²	X (SD)	22.3 4.0	21.9 3.7	22.1 3.0	21.4 2.8	20.9 1.4	20.7 1.2
	Z	**1.992***	**2.375***	1.892			
Basal Metabolic Rate (BMR) Kcal	X (SD)		1758.7 125.4	1733.6 128.6	1711.5 147.0	1681.9 111.4	1673.1 105.7
	Z	**2.366***	**2.521***	1.859			
Impedance (IMP) kg/m²	X (SD)	464.9 58.8	465.9 63.8	487.8 47.5	498.3 42.1	468.7 69.5	490.7 31.0
	Z	0.000	0.841	0.169			
Fat Percently (FAT) %	X (SD)	11.1 5.3	10.4 5.1	11.8 4.7	12.0 4.9	9.6 2.8	9.9 2.1
	Z	**2.028***	1.778	1.183			
Fat Mass (FATMASS) Kg	X (SD)		8.0 4.7	7.4 4.4	7.7 4.1	6.3 2.4	6.4 1.7
	Z	**2.207***	**2.201***	1.183			
Fat Free Mass (FFM) Kg	X (SD)		60.4 5.9	59.5 6.1	58.3 6.3	58.1 3.9	57.5 4.5
	Z	**2,201***	**2,316***	0,847			
Total Body Water (TBW) Kg	X (SD)	44.2 4.3	43.6 4.1	43.6 4.5	42.7 4.6	42.6 2.9	42.1 3.3
	Z	**2.023***	**2.207***	0.847			

Table 2: Comparison of the pre and post tests for BIA values of the groups

Body Composition Measurements

Measuraments of the participants' body composition evaluations were made between 08:00-10:00 in the morning, without any liquid and food intake during 12-hours prior to the measurements.

Measurements were taken while the participants had standard workout clothes (short and t-shirt) and no shoes on them.Leg-to-Leg Bio-Electric Impedence Analysis (BIA) method (Tanita Body Fat Analyser, Model TBF 300-Japan) was used to evaluate the participants' body weight and composition.

Analysis

Non-parametric tests were used to analyze the data, which does not indicate normal distribution and homogenity.Wilcoxon Signed Ranks Test was used to see the difference between the dependent groups and Mann Whitney U test was used to see the difference between the independant groups. Statistical analysis was carried out using SPSS version 18.0 (SPSS, Inc., Chicago, IL, USA).Data are presented as means ±SD and significance level was set at $p<0.05$.

Results

Table 3: Comparison of post tests for BIA values of the groups

GROUPS	GWBVEG(n=8)		GEG (n=7)	GWBVEG(n=8)	CG (n=8)	GEG(n=7)	CG (n=8)
	Post Test			Post Test		Post Test	
BIA VALUES							
Body Mass (BM) Kg	X (SD)	66.0 9.6	66.8 9.9	63.9 5.6	66.8 9.9	63.9 5.6	66.0 9.6
	Z	0.000		0.767		0.579	
Body Mass Index (BMI) Kg/m^2	X (SD)	21.4 2.8	21.9 3.7	20.7 1.2	21.9 3.7	20.7 1.2	21.4 2.8
	Z	0.174		0.064		0.521	
Basal Metabolic Rate (BMR) Kcal	X (SD)	1711.5 146.9	1733.6 128.6	1673.1 105.7	1733.6 128.6	1673.1 105.7	1711.5 146.9
	Z	0.579		1.342		0.694	
Impedance (IMP) kg/m^2	X (SD)	498.3 42.1	465.9 63.8	490.7 31.0	465.9 63.8	490.7 31.0	498.3 42.1
	Z	1.448		1.342		0.231	
Fat Percently (FAT) %	X (SD)	11.1 4.9	10.4 5.1	9.9 2.1	10.4 5.1	9.9 2.1	11.1 4.9
	Z	0.347		0.064		0.231	
Fat Mass (FATMASS) Kg	X (SD)	7.7 4.1	7.4 4.4	6.4 1.7	7.4 4.4	6.4 1.7	7.7 4.1
	Z	0.347		0.192		0.347	
Fat Free Mass (FFM) Kg	X (SD)	58.3 6.3	59.5 6.1	57.5 4.5	59.5 6.1	57.5 4.5	58.3 6.3
	Z	0.348		1.535		0.753	
Total Body Water (TBW) Kg	X (SD)	42.7 4.6	43.6 4.5	42.1 3.3	43.6 4.5	42.1 3.3	42.7 4.6
	Z	0.348		1.537		0.753	

When the GWBVEG group's pre and post tests of BIA values were compared (Table 2); while there was no significant difference in Impedance (IMP) value, there was a significant difference in all other values (464.9±58.8 kg/m^2, 465.9±63.8 kg/m^2) ($p<0.05$).

When the pre and post tests for GEG Group's BIA values were compared; while there was significant difference in Body Mass (BM) (67.9±9.6 kg, 66.0±8.6 kg), Body Mass Index (BMI) (22.1±3.0 kg/m^2, 21.4±2.8 kg/m^2),Basal Metabolic Rate (BMR) (1733.6±128.6 kcal, 1711.5±147.0 kcal),Fat Mass (FATMASS) (7.4±4.4 Kg, 7.7±4.1 kg),Fat Free Mass (FFM) (59.5±6.1 kg, 58.3±6.3 kg), Total Body Water (TBW) (43.6±4.5 kg, 42.7±4.6) values, no significant difference was observed in other values ($p<0.05$).

No significant difference was found for the control group ($p<0.05$).

Discussion

It can be stated that in the literature (Bosco, C. et al., 1999; Demirel, N. et al., 2009;Fjeldstad, C. et al. 2009; Kinser, A. M. et al. 2008; Verscheuren, S. et al. 2004), vibration workouts' various durations and training protocols affected body compositions in general positively and therefore, demonstrated similarity with our study. In the study that we conducted, we can consider that the negative significant difference ($p<0.05$) that happened in the control group's BIA values happened as a result of the loss of motivation due to weight gain.

In a metabolic study that investigated the effects on body composition, Bonner (1999) observed that 10-minutes vibration training performed during 6 months, 3 days per week can increase the resting metabolism by 18%, and that similar workouts without the use of vibration exercise would reduce the resting metabolism by 2% rate (Bosco, C. et al. 1999).

The purpose of Frank and Moss' (2003) research was to examine the effect of vibration training on cellulite.Participants were divided into three groups as Vibration (Power Plate), Traditional Endurance (Cardio) and Control.An average of 25.68% reduction occured in Power Plate group's total body weight and in most important parameters, including the cellulite, following the Power Plate workout of 10 minutes each session during a period of 6 months with a total of 11 hours.An avarage of 32.30% decrease occurred in the training group that participated in the Cardio exercise, following a total of 40 hours workout, 45 minutes each, 2 to 3 times a week during 6 months.In both groups (Vibration and Cardio), anthropometric measures slightly decreased and this reduction was not significant.As a result, it was concluded that vibration training is an effective method with no side effects on reducing the severity of cellulite (Frank, H., Moos, B. 2003).

The goal of the study conducted byRoelants (2004) et al. was to determine and compare the effects of 24-weeks whole-body vibration (WBV) and Fitness training on body composition and muscle strength. 48 untrained females participated in the study. The WBV group (n = 18) performed weightless static and dynamic exercises on vibrating platform (35 - 40 Hz, 2.5 - 5.0 mm; Power Plate). The Fitness group (n = 18) participated in standard cardiovascular (15-40 min) and resistance training program (20-8 Repetitions Maximum). Both groups worked out 3 days per week. The control group did not participate in any exercise program. There was no significant change in none of the groups' weight, % body fat or skinfold thickness during 24 weeks. Lean body mass increased significantly only in the WBV group (+ 2.2%). To conclude, a 24-weeks WBV program does not reduce participant females' weight, body fat percentage or the thickness of subcutaneous; while it brings about a slight increase in the fat-lean muscle mass.When compared with the results of our research, the findings show similarity (Roelants, M. et al., 2004).

Moody (2007) et al., in the research that they conducted on females in the years of 1969 and 1972, examined the effect of training on body composition. In their study, they found that training provides a significant reduction in body fat, a slight increase in lean body weight and a slight decrease in total body weight (Paradisis, G., Zacharogiannis, E., 2007).

BMI values of the first and last test, while a statistically significant difference of 0.01 was observed between these measured values. A decrease of 6.61 was achieved between the body fat rate values of the first and last test, while a statistically significant difference of 0.01 was observed between these values (Kolukisa, S., 2015). It can be deducted that the resulting changes signify that the gymnastics training performed with the selected protocol and for the selected period of time impacted body composition positively in general terms and that our research findings were similar to findings from the literature (Delecluse, C. et al., 2003; Yılmaz, C., 1997; Torvinen, S., 2003).

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