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Effect of Vibration Training on Some Physical Variables and Level of the Skill Performance on a Horse Jumping

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Abstract: This study was designed to investigate the effects of an 8-weeks whole-body vibration training program on developing some physical variables (muscular strength, speed and flexibility) and the skill performance level on the horse jumping (front handspring) for female gymnastics students. The experimental method was used, twenty-four female gymnastics students (ages 19-21 years) were randomized to either the experimental vibration group (n = 12) or control group (n = 12). The vibration intervention consisted of an 8-wk whole-body vibration 3 times a week employed by standing on a vertical vibration platform. As outcome measures, physical variables tests (muscle strength of the arms, muscle strength of the two men, muscle of the abdomen, muscle strength-to-back, muscular ability of legs the sergeant test: 30 meters speed running in second (sec.) and a sit-and-reach test for flexibility) were performed initially and after 8 wks. Statistical treatment included the arithmetic means, the standard deviation, the T-test and the improvement percentage. The major result was that there are statistically significant differences in the studied physical variables and skillful performance level on the horse jumping (front handspring) for female gymnastics students. In the experimental vibration group whole-body vibration induced significant improvement of physical variables ($P < 0.05$) and the skill performance level on the horse jumping (front handspring) ($P < 0.05$) among female gymnastics students after 8 weeks of training. Small or No significant changes were found for all the outcome measures for the control group. Whole-body vibration is a suitable training method to improve some physical variables (muscle strength of the arms, muscle strength of the two men, muscle of the abdomen, muscle strength-to-back, muscular ability of legs, speed and flexibility) and the skill performance level on the horse jumping (front handspring) for female gymnastics students if it is properly designed.

Key words: Vibration training % Physical variables % Performance level

INTRODUCTION

In the recent times there are a remarkable development in the sport of gymnastics reflected in the innovation and difficulty of performing movement routines on different apparatuses. In the past 10 year there has been an increasing interest in the somewhat strange concept of vibration training and its potentially positive impact on athletic performance. Vibration training has become increasingly accessible and used at sports and rehabilitation centers. Vibration training or whole body vibration (WBV) on vibration platform is a neuromuscular training method that has recently received a great deal of interest [1, 2].

Literature survey shows that a low-amplitude, high frequency stimulation of the whole body vibration training improves muscle strength, body balance and mechanical competence of bones [3], has positive effect on the explosive speed and force [4] and has effect on muscle performance and flexibility in female competitive athletes [5]. Bosco *et al.* [6] showed that a single vibration about (10 min in intervals at the frequency of 26 Hz) resulted in a significant temporary enhancement in muscle strength of lower extremities in female volleyball players. Armstrong *et al.* [7] had studied the acute effect of vibration upon the high jump, drawing the conclusion that the effect is minimal and variable, being influenced by the position of the body. Four weeks of vibration training

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during the transition period in a competition, for performance athletes is considered to be a short term efficient stimulus for the improvement of the power in knee and jump extensors [8]. Significant increases can be obtained in the vertical jump if, during the athlete training sessions on the vibration platform are introduced [9].

The side horse is an important apparatus with an evaluation score equal to scores given for other gymnastics apparatuses in spite of the fact that performance on the horse is evaluated through performing only one skill compared to the several skills required to evaluate performance on other apparatuses.

Despite the aforementioned preliminary positive findings and wide use of different vibration devices among athletes, reports on the effects of vibration training, especially in female athletes, remain poor. The researcher, in teaching the fourth year female students of the Faculty of Physical Education, Zagazig University, Egypt found that the performance level of the front handspring on the horse is weak. Therefore, the purpose of this study was to investigate the effects of an 8-wk whole-body vibration training program on developing some physical variables (muscular strength, speed and flexibility) and the skill performance level on the horse jumping (front handspring) among female gymnastics students.

MATERIALS AND METHODS

Twenty four female fourth-year students (ages 19 - 21 years old), majoring in gymnastics in the Faculty of Physical Education, Zagazig University, Zagazig, Egypt in the academic year 2010 - 2011 (Table 1). The researcher was used the experimental method with measuring the physical variables and level of performance pre and post the study by dividing the sample into two groups, one experimental vibration group and the other controlled group with equal number of students in both groups (Fig. 1).

The vibration training platform program was applied on the experimental group to vibration practices for the duration of eight weeks WBV training (3 training sessions/ week) (rest period between two training sessions = 1-2 days), it was implemented from 17/10/2010 to 12/12/2010. The evaluation tests were done at baseline (before) and at the end of the training program after 8 wks.

The participants stood on the platform with the following six positions:

1) standing upright with knees semi-locked; (2) isometric squat at a knee angle of approximately 120~; (3) squatting at a tempo 2 s up and 2 s down at a knee angle

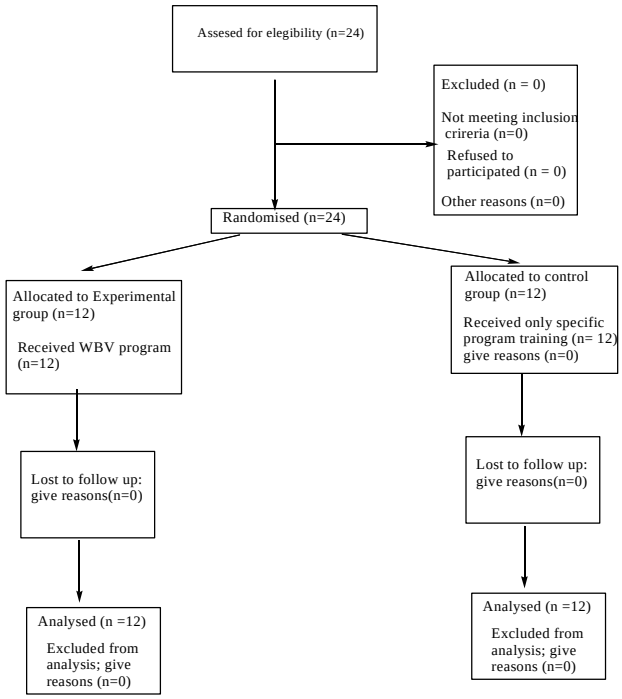

Fig. 1: Flow diagram for selection of the subjects

Table 1: Subjects characteristics

	Mean ± SD	
Characteristic	Experimental group	Control group
N	12	12
Age (years)	20.45 ± 1.27	20.28 ± 1.53
Height (cm)	166.75 ± 6.14	163.21 ± 5.90
Weight (kg)	63.75 ± 3.59	62.56 ± 4.05

of approximately 120~; (4) kneeling on the ground with arms straight and hands placed on the platform equating to a peak to peak amplitude of 4 mm of vertical vibration; (5) lunge position with left leg on platform and right leg on ground; and (6) lunge position with right leg on platform and left leg on ground.

Whole body vibration training loading on the platform was developed through 8-wk WBV program with a low training load at the beginning but slowly progressive according to the overload principle. The training volume increased systematically over the 8-wk training period by increasing the duration of one vibration session (30-60 seconds), the number of series of one exercise, or the number of different exercises. The training intensity was increased by: shortening the rest periods or by increasing the amplitude (2.0-4.0 mm) and/or the frequency (25-50 Hz) of the vibration.

Control Group: The control group was performed on the platform (0 Hz, amplitude 0 mm) with the exact same six body positions and time constructions as described for the WBV training program.

Research Tools Included Physical Tests:

- The muscle strength of the arms, the two men and back was measured using dynamometer.
- Measure abdominal muscular endurance by performing the 1-minute sit-up test. Lie on your back with your knees bent at a 90-degree angle and your feet flat on the floor. Interlock your fingers behind your head, then slowly rise to a sitting position and touch your elbows to your knees. Lower yourself body back to the starting position and then repeat the process as many times as possible as your partner times you for 1 minute.
- The sergeant test for high jump, measured by centimeters (cm) for determining the muscular ability of legs.
- 30 meters speed running test, measured in seconds (sec).
- Flexibility was measured using the sit and reach test which conducted on the vibrating plate with the feet placed against a graduated rules. The knees were held extended by the tester. Participants were instructed to lean downward slowly as far as possible toward graduated rules from -30 to +30, holding the greatest stretch for 2 seconds. The tester had to be sure that there were not jerky movements on the subject and that her/his fingertips remained at the level. The score was recorded as the distance before (negative) or beyond (positive) the toes. The test was repeated twice with a rest period of 10s and the best score was recorded.

Statistical Processing: Statistical analysis and processing was realized using SPSS for Windows version 14.0 program and the graphic representation and charting was done using Excel-Office 2007. The significance level for the pre and post measurements was realized with paired Student t- test at $p < 0.05$ and the data was presented as mean ± SD. To determine the correlation between tests a person (r) correlation was applied on the groups.

RESULTS AND DISCUSSION

Table 2 shows statistical significant differences at a significant level of 0.05 between pre-tests and post-measurements in some physical and skillful variables studied for the experimental group subjects. T-value varied between 4.63 and 20.39 and percent of improvement varied between 6.45 and 59.32 which show a statistically significant improvement in the vibration experimental group (Fig. 2).

Table 3 shows statistical very small significant differences at a significant level of 0.05 between pre-tests and post-measurements in muscle strength of the arms, muscle strength of the two men, muscle strength to back, flexibility and the skill level of performance and no significant in muscle of the abdomen, muscular ability of legs and speed for the control group. T-value varied between 1.33 and 3.24. And percent of improvement varied between 1.55 and 9.05 which show a statistically small significant improvement in the control group (Fig. 3).

Table 4 shows statistical significant differences at a significant level of 0.05 between the two post-measurements in all physical and skillful variables studied favoring the experimental group. T-value varied between

Table 2: Significance of Differences between Pre and Post-Measurements in the Physical and Skillful Variables in the Experimental Group

		Mean					
Variables	Unit	Pre	Post	Mean Difference	SD difference	T	Improvement %
Muscle strength of the arms	Kilogram	23.79	28.33	4.54	0.98	16.07	19.08
Muscle strength of the two men	Kilogram	47.25	55.15	7.92	4.94	5.55	16.76
Muscle strength-to-back	Kilogram	39.50	45.92	6.42	1.98	11.25	16.25
Muscle of the abdomen	Number	28.42	35.42	7.0	2.0	12.12	24.46
Muscular ability of legs	Centimeter	35.83	46.33	10.50	1.78	20.39	29.30
Speed	Second	5.12	4.79	0.33	0.25	4.63	6.45
Flexibility	Centimeter	13.69	19.28	5.58	1.63	11.83	40.76
The skill level of performance	Degree	8.21	13.08	4.87	1.05	16.13	59.32

*The tabulated T value at significant level of 0.05 = 2.20

Table 3: Significance of differences between pre and post measurements in the physical and skillful variables in the control group

		Mean					
Variables	Unit	Pre	Post	Mean Difference	SD difference	T	Improvement %
Muscle strength of the arms	Kilogram	23.71	24.83	1.12	1.36	2.86	4.72
Muscle strength of the two men	Kilogram	46.83	49.17	2.34	2.50	3.24	5.0
Muscle strength-to-back	Kilogram	39.50	40.92	1.42	1.73	2.84	3.59
Muscle of the abdomen	Number	28.50	28.75	0.50	0.90	1.92	1.77
Muscular ability of legs	Centimeter	34.50	35.67	1.17	3.04	1.33	3.39
Speed	Second	5.17	5.09	0.08	0.16	1.61	1.55
Flexibility	Centimeter	13.64	14.52	0.88	1.33	2.28	5.87
The skill level of performance	Degree	8.29	9.04	0.75	0.99	2.63	9.05

*The tabulated T value at significant level of 0.05 = 2.20

Table 4: Significant differences between the post- measurements for the experimental group and control group in physical variables and the skill level of performance

	Experimental WBV group		Control group		
Variables	Mean	SD	Mean	SD	T
Muscle strength of the arms	28.33	2.15	24.83	1.40	4.52
Muscle strength of the two men	55.17	2.52	49.17	2.51	5.59
Muscle strength-to-back	45.92	3.23	40.92	1.93	4.41
Muscle of the abdomen	35.42	2.02	28.75	1.76	8.25
Muscular ability of legs	46.33	2.10	35.67	2.11	11.88
Speed	4.79	0.15	5.09	0.19	4.11
Flexibility	19.28	1.46	14.52	0.96	9.10
The skill level of performance	13.08	0.79	9.04	0.84	11.61

*The tabulated T value at significant level of 0.05 = 2.07

4.11 and 11.88 which show a statistically significant improvement in the vibration experimental group more than the other control group (Fig. 4).

The effects of vibration on the human body have been documented for many years. Recently, the use of vibration for improving the training regimes of athletes has been investigated [10].

The use of WBV as a tool for improving functional performance (e.g. flexibility, strength, power and balance) was studied [11-14]. Enhancement of athletes' flexibility as a result of vibration training has been shown in both short term and long-term studies. Issurin *et al*. [15] found significant acute effect of vibratory stimulation on training on maximal force and flexibility on vibrating gymnastic rings.

Table 2 shows statistical significant differences at a significant level of 0.05 between pre-tests and post-measurements in some physical and skillful variables studied for the experimental group subjects. T-value varied between 4.63 and 20.39 and percent of improvement varied between 6.45 and 59.32 which show a statistically significant improvement in the vibration experimental

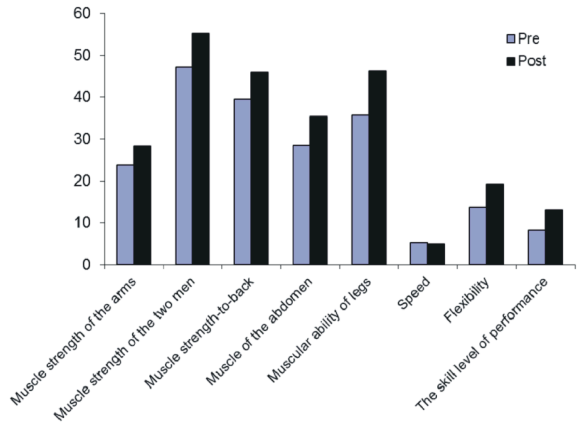

Fig. 2: Relative change of some physical variables and level of skillful performance for pre and post-measurements after whole-body vibration for the experimental group

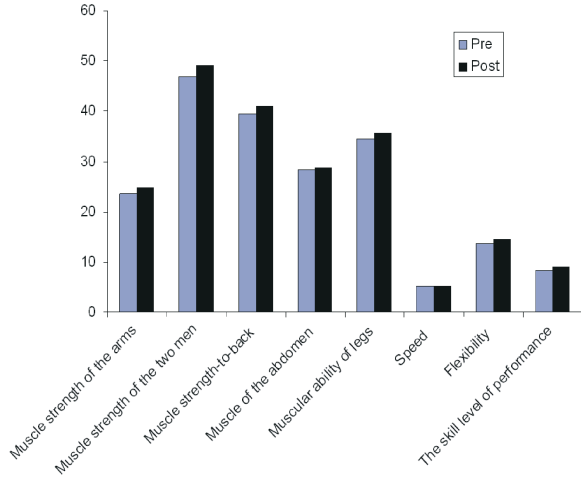

Fig. 3: Relative change of some physical variables and level of skillful performance for pre-and post-measurements for the control group.

group. The researcher suggests that this is due to the effect of vibration training which increases muscular strength (muscle strength of the arms, muscle strength of the two men, muscle strength-to-back, muscle of the abdomen, muscular ability of legs); speed and flexibility and also development in gymnastics skillful performance on a horse jump.

These results also agreed with the content of the studies of Armstrong *et al.* [7] which had studied the acute effect of vibration s upon the high jump and concluded that the effect is minimal and variable, being influenced by the position of the body; Iuliana and Simona [4] concluded that the vibration training has

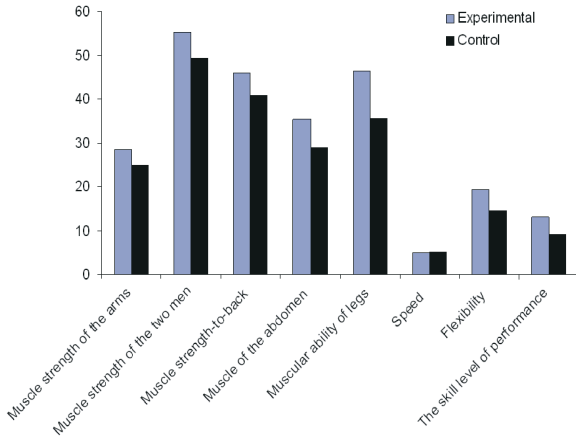

Fig. 4: Relative change of some physical variables and level of skillful performance for post-measurements for comparing the experimental and control groups

positive effect upon the explosive force and speed of basketball players and the vibration training can be considered an alternative method in the training of performance athletes and a way of maintaining motor functions at optimal parameters during the transition period and Wyon *et al.* [9] concluded that there are significant increases in the vertical jump if, during the athlete training sessions on the vibration platform are introduced.

Table 3 shows statistical very small significant differences at a significant level of 0.05 between pre-tests and post-measurements in muscle strength of the arms, muscle strength of the two men, muscle strength to back, flexibility and the skill level of performance and no significant in muscle of the abdomen, muscular ability of legs and speed for the control group. T-value varied between 1.33 and 3.24. and percent of improvement varied between 1.55 and 9.05 which show a statistically small significant improvement in the control group.

Table 4 shows statistical significant differences at a significant level of 0.05 between the two post measurements in all physical variables (muscle strength, speed and flexibility) and skillful variables studied favoring the experimental group. T value varied between 4.11 and 11.88. The researcher suggests that these increases and improving in physical variables and skillful performance level for the experimental group more than the other control group are due to the effectiveness of the vibration training.

CONCLUSION

Whole-body vibration is a suitable training method to improve some physical variables (muscle strength of the arms, muscle strength of the two men, muscle of the abdomen, muscle strength-to-back, muscular ability of legs, speed and flexibility) and the skill performance level on the horse jumping (front handspring) for female gymnastics students if it is properly designed.

REFERENCES

1. Abd Al-Khaliq, E., 2003. Sports Coaching Theories of applications. Business knowledge, Alexandria, pp: 11: 164.
2. Abercromby, A.F., W.E. Amonette, C.S. Layne, B.K. McFarlin, M.R. Hinman and W.H. Paloski, 2007. Vibration exposure and biodynamic responses during whole-body vibration training. Med. Sci. Sports Exerc., 39: 1794-1800.
3. Delecluse, C., M. Roelants and S.Verschueren, 2003. Strength increase after whole-body vibration compared with resistance training. Med. Sci. Sports Exerc., 35: 1033-1041.
4. Iuliana, B.B. and M.Simona, 2010. The Effect of the vibration training upon the explosive force and speed of basketball players, Stusia Ubb. Educatio Artis Gymnasticae, LV, 4: 13-19.
5. Fagnani, F., A.Giombini, A. Di Cesare, F. Pigozzi and V. Di Salvo, 2006. The Effects of a Whole-Body Vibration Program on Muscle Performance and Flexibility in Female Athletes.Am. J. Phys. Med. Rehabil., 85: 956-962.
6. Bosco, C., M. Cardinale and O. Tsarpela, 1998. The influence of whole body vibration on jumping performance. Biol. Sport, 15: 157-164.
7. Armstrong, W.J., D.C. Grinnell and G.S. Warren, 2010. The acute effect of whole-body vibration on the vertical jump height. J. Stength Cond. Res., 24: 2835-3849.
8. Colson, S.S., M. Pensini, J. Espinosa, F. Garrandes and P. Legros, 2010. Whole-body vibration training effects on the physical performance of basketball players. J. Stength Cond. Res., 24: 999-1006.
9. Wyon, M., D. Guinan and A. Hawkey, 2010. Whole-body vibration training increases vertical jump height in adance population. J. Stength Cond. Res., 24: 866-870.
10. Torvinen, S. P. Kannus and H. Sievanen, 2002. Effect of four month vertical whole body vibration on performance and balance. Med. Sci. Sports and Exerc. 34: 1523-1528.
11. Roelants, M., C. Deleccuse and S. Verschueren, 2004. Whole-body vibration training increases knee-extension strength and speed of movement in older women. J.A.G.S. 52: 901-908.
12. De Ruiter, C.J., S.M. Van Raak, J.V. Schilperoort, A.P. Hollander and A. De Haan, 2003. The effects of 11 weeks whole body vibration training on jump height, contractile properties and activation of human knee extensors. Eur. J. Appl. Physiol., 90: 595-600.
13. Warman, G., B. Humphries and J. Purton, 2002. The effects of timing and application of vibration on muscular contractions, Aviation Space Environ Med., 73: 119-127.
14. Cardinale, M. and J. Wakeling, 2005. Whole body vibration exercise: are vibrations good for you?. Br. J. Sports. Med., 39: 585-589.
15. Issurin, V.B., D.G. Liebermann and G. Tenenbaun, 1994. Effect of vibratory stimulation on training on maximal force and flexibility. J. Sport Sci., 12: 561-566.