Corredoira, F. y Durán, J.A. (2012). Efecto agudo del entrenamiento vibratorio en jugadoras de baloncesto femenino / Acute effects of whole-body vibration training in female basketball players. Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte vol. 12 (48) pp. 625-633 Http://cdeporte.rediris.es/revista/revista48/artefecto320.htm

ORIGINAL

ACUTE EFFECTS OF WHOLE-BODY VIBRATION TRAINING IN FEMALE BASKETBALL PLAYERS

EFECTO AGUDO DEL ENTRENAMIENTO VIBRATORIO EN JUGADORAS DE BALONCESTO FEMENINO

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Código UNESCO / UNESCO code: 2411.06 Fisiología del ejercicio / Physiology of exercise
Clasificación del Consejo de Europa / Classification Council of Europe: 6. Fisiología del ejercicio / Physiology of exercise

ABSTRACT

The aim of this study was to determinate the acute effect of whole-body vibration training in basketball players. Twelve women basketball players from Spanish League 2 took part in a vibration session. A 30Hz vibration frequency was chosen, as well as 4mm amplitude on a vibration platform.

The improvement of muscle strength was evaluated on a platform of contacts throughout the protocol Bosco, and so was flexibility through the sit and reach protocol.

There were significant differences between pretest and post-test of explosive-elastic-reactive strength and pretest and post-test after 2min of recovery after exposure to vibratory stimulation of explosive strength, explosive-elastic-reactive strength and flexibility ($p<0.05$).

The results show evidence that vibration training can be a good tool for improving jumping ability and flexibility in female basketball players as this can have an influence on their efficiency at specific times of the season.

KEY WORDS: muscle power, flexibility, vibration platform.

RESUMEN

El objetivo del estudio fue cuantificar el efecto agudo del entrenamiento vibratorio en jugadoras de baloncesto. Doce jugadoras de baloncesto de Liga Femenina 2 realizaron una sesión de entrenamiento vibratorio con una frecuencia de 30Hz y amplitud de 4mm sobre una plataforma vibratoria.

Se valoró la mejora de fuerza muscular sobre una plataforma de contactos a través del protocolo de Bosco y de la flexibilidad, a través del protocolo sit and reach. Existen diferencias significativas entre el pretest y el postest de fuerza explosiva-elástico-reactiva y los pretests y postest tras 2min de recuperación después de la exposición al estímulo vibratorio de la fuerza explosiva, fuerza explosiva-elástico-reactiva y flexibilidad ($p<0.05$).

Los resultados obtenidos muestran que el entrenamiento vibratorio puede ser una buena herramienta para la mejora de la capacidad de salto y la flexibilidad en jugadoras de baloncesto, ya que puede incidir sobre su rendimiento en momentos determinados de la temporada.

PALABRAS CLAVE: potencia muscular, flexibilidad, plataforma vibratoria

1. INTRODUCTION

Basketball is characterized by being an intermittent sport requiring explosive actions such as fast, repeated accelerations, jumps, and direction changes (McInnes et al., 1995). Proper training of conditional capabilities of explosive strength and flexibility are of great importance, both for the individual and collective performance; as well as for injury prevention.

Vibration training has been used over the last decade to improve the performance of athletes (Cardinale et al., 2005). It is true that there is some disagreement on the methodology to be used in vibration training, as it happens with frequency and amplitude of vibration stimulation; the number and duration of sessions; or the test protocol for the evaluation of the different conditional capacities used (Nordlund et al., 2007).

Long-term vibration training in young athletes do not show positive results in terms of improved jumping ability in different disciplines (Dolny et al., 2008) and, more recently, women's basketball (Colson et al.; Fernández et al., 2010). Other studies, however, do prove the long-term positive effect on flexibility training

(Fagnani et al., 2006; Van Den Tillaar, 2008). Nevertheless, the acute effects of vibration training on neuromuscular improvement of athletes are less consistent.

The aim of this study was to quantify the acute effect of vibration training on the strength and flexibility of the lower body in LF2 basketball players.

2. MATERIAL AND METHODS

This study involved a total of 12 players of LF2 Ensino Basketball Club Lugo (2009-10), with the following averages: Age: 22 ± 4.56 years; Height: 1.74 ± 0.08 m; Weight: 70.57 ± 10.86 kg. Body mass index (BMI): 22.95 ± 1.83 kg / m². The study was conducted within the competitive period (May of 2010), on a training session after a resting day.

Subjects performed a warm-up consisting in the activation and implementation of joint mobility exercises for the lower limbs. Later, a valuation of the Force was made through the Bosco jumping battery system (2000) using the Ergojump Boscosystem platform, recording the explosive strength values (Squat Jump, SJ); the explosive-elastic-strength (countermovement jump, CMJ) and reflective-elastic-explosive strength (Drop Jump, DJ). Two jumps in each category were performed, taking the best result in each of them. An assessment of the flexibility through the sit and reach protocol was also made.

After the initial test, each player is situated on the vibrating platform (PowerPlate, The Netherlands), placing their feet on an area marked 19 centimeters on each side from the center point of the base. The frequency used was 30 Hz with amplitude of 4 mm and vertical vibration. Players had to perform a unique series of 60 s with 60 s of recovery with the following exercises: squat with rise and fall times of 2 s; lunge with left leg on the platform and right leg on the ground; lunge with right leg on the platform and left leg on the ground; flexion and extension of calves.

After performing the vibration training, each person again held two vertical jumps of the same features, one after 30 s, and the other after 2 min of having completed the vibratory stimulus, following Martínez protocol (2007).

Figure 1. a) Squat. b) Lunge y c) Flexion and extension of calves.

For statistical analysis of the data, SPSS v. 17.0 software package was used (SPSS Inc., USA). We performed a Student t test for two related samples in order to establish differences between the results of the pretest, post-test and post-test after 2 min.

3. RESULTS

All subjects completed the study without showing any side effects. Likewise, none of them experienced adverse reactions or exhaustive fatigue after the 4 series of 60-second vibratory stimulation.

Once known the normal state of the sample, a descriptive analysis of the different variables is performed. We record the mean values and standard deviation of the different jumps performed before the study; immediately at the end of the training; and two minutes after finishing vibrational work (Table 1, Figures 2, 3 and 4).

Maximum values in SJ (28.14 ± 3.69 cm) in CMJ (27.95 ± 4.01 cm) and DJ (28.88 ± 4.05 cm) are reached 2 min after vibration training.

	Pretest SJ (cm)	Postest inmediato SJ (cm)	Postest SJ 2´ (cm)	Pretest CMJ (cm)	Postest inmediato CMJ (cm)	Postest CMJ 2´ (cm)	Pretest DJ (cm)	Postest inmediato DJ (cm)	Postest DJ 2´ (cm)
N	12	12	12	12	12	12	12	12	12
Media	26,5	26,3	28,1	27,5	26,5	27,9	27,1	28,1	28,8
Desv. típ.	3,48	4,92	3,69	3,88	4,70	4,01	4,46	4,27	4,05
Min.	21,06	21,27	23,09	22,12	21,83	23,43	20,33	22,49	22,98
Max.	35,09	37,81	35,83	34,53	37,76	37,01	38,88	39,29	36,37

Table 1. Descriptive analysis of different jumps, Squat Jump (SJ), countermovement jump (CMJ) and drop jump (DJ).

Table 2 shows the mean and standard deviation of the variable of the flexibility obtained prior to the test (8.46 ± 6.13 cm) and two minutes after completion of the same (9.52 ± 5.58).

	Pretest Flexibilidad (cm)	Postest Flexibilidad (cm)
N	13	13
Media	8,4615	9,5231
Desv. típ.	6,13209	5,58542
Mínimo	-3,00	-1,00
Máximo	20,00	19,00

Table 2. Descriptive analysis of the sit and reach.

You can see evidence of the presence of statistical significance between the SJ, DJ pretests, and variables corresponding to SJ conducted 2 min. after ($p = 0.009$); immediate DJ ($p = 0.046$); and DJ 2 min later ($p = 0.044$); as well as flexibility in the initial test and flexibility test made 2 min after stimulation ($p = 0.029$).

However, no significant differences were appreciated between SJ ($p = 0.829$), CMJ performed immediately ($p = 0.181$); CMJ 2 min after vibration stimulation ($p = 0.712$); and their initial tests respectively.

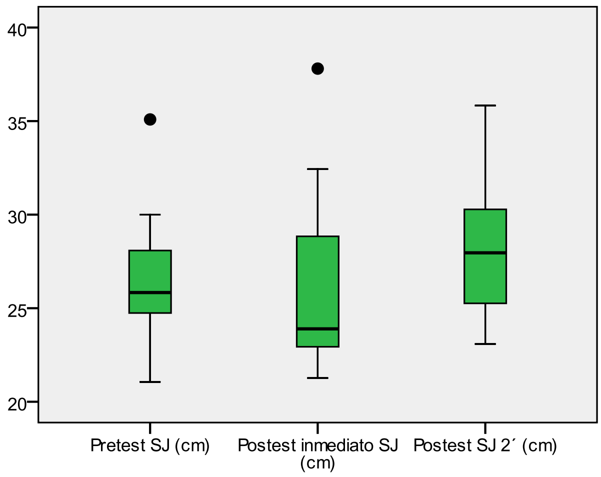

Figure 2. Squat jump Test (SJ) in the pretest, immediate post-test immediately, and after 2 min post-test

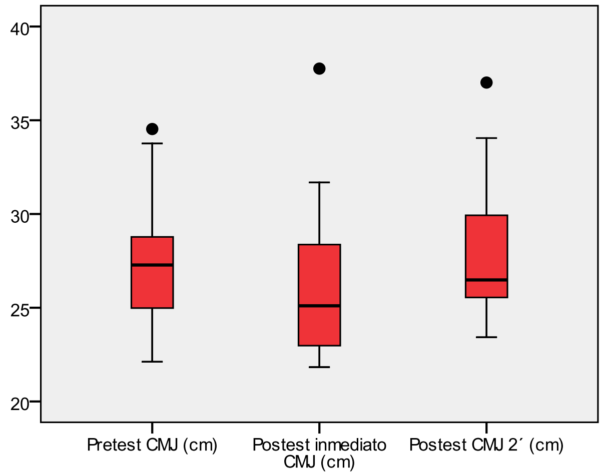

Figure 3. Countermovement Jump Test (CMJ) in the pretest, immediate post-test immediately, and after 2 min post-test.

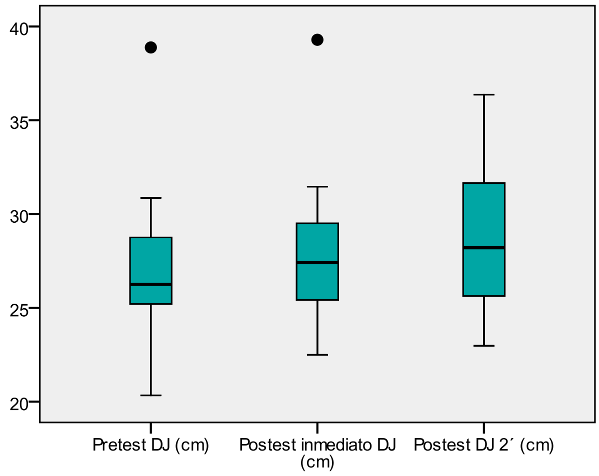

Figure 4. Drop Jump Test (DJ) in the pretest, immediate post-test immediately, and after 2 min post-test.

4. DISCUSSION

Over the last years, vibration training has become a widely used method to improve muscle strength and power (Rittweger et al., 2002; Torvinen et al., 2002b and 2002c). In order to understand the effects of mechanical vibration on explosive strength, physical trainers use as an indirect measure the results derived from the Bosco protocol (2000).

With this cross-sectional study, we can see that four 60-second series of dynamic exercise on a vibrating platform induce an improvement in jumping ability and flexibility after 2 min of recovery after vibration stimulation. In contrast, jumping ability was diminished 30 s after stimulus which suggests a decline in performance due to fatigue. Rittweger et al. (2000) also showed a significant decrease in the height 10 s after the vibration, although it was applied until the exhaustion of the subjects.

Taking into account the frequency, amplitude and duration of vibration stimulation, the results differ with those found by Cardinale et al. (2003), which showed no significant improvements in SJ after performing five 60-second series with a frequency of 40Hz. However, Torvinen et al. (2002a), after 4 min of vibratory stimulation showed a significant increase 2 min after the exposure. Cochrane et al. (2005) used a frequency of 26 Hz and amplitude 6mm with 6 different 60-second exercises on a group of female hockey players. The results showed improvements both in muscle strength and flexibility, like in the study we have done. More recently, Gerodimos et al. (2009) have concluded that the optimum flexibility increase followed by a vibratory stimulus occurs between 15-30 Hz frequency and amplitude 4-8 mm lasting 6 minutes on the vibrating platform, duration which is produced at least 15 min after exposure to the stimulus.

As regards the long-term effects, Colson et al. (2010) showed that 4 weeks of vibration training added to conventional training in basketball players during the preseason improves maximal isometric force of the knee extensor and SJ performance slightly, but did not change the explosive abilities (CMJ, DJ, and 30 s of continuous rebounds). Fagnani et al. (2006) show in their 8-week study an improvement in the flexibility and CMJ in female athletes from several sports, basketball among them. However, Fernandez et al (2010) indicated that vibration training has no perceptible or additive effect on the strength development of female basketball players after several weeks of use, which suggests that the application of this technology has no advantages over traditional methods of strength training.

5. CONCLUSIONS

The basketball players who undergo a training session based on vibratory stimuli show improvements in explosive strength and elastic-reactive-explosive strength, as well as in the elasticity of posterior thigh muscles of the lower body, as measured by both the Bosco protocol and sit and reach.

The results obtained in this study show that vibration training may be a good intervention exercise to improve short-term neuromuscular capacity, because it can affect its performance at certain times of the season, such as playoff or promotion/relegation games; always taking into account the objective pursued with such vibratory stimulations. An improvement in the flexibility of the lower body is also obtained, which not only favors the performance but works also as a method of preventing injuries in the muscle-tendon junction.

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Rev.int.med.cienc.act.fís.deporte- vol.12 - número 48 - ISSN: 1577-0354