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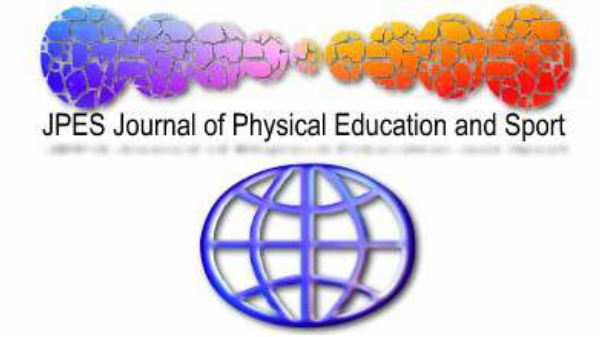

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ORIGINAL RESEARCH

USING WHOLE BODY VIBRATION TO IMPROVE JUMP ABILITY IN YOUNG RECREATIONAL SPORTMEN

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ABSTRACT

The whole body vibrations (WBV) it is nowadays one of the most widely used methods for improving the explosive strength. In this study, 12 subjects participating in recreational physical activity were allocated to a 5 sets of 60 s training, using a frequency of 30 Hz, an amplitude of 2.5 mm. and a isometric position (110 ° bending knees) on a Galileo Fitness ® (Novotech, Germany) platform. The results showed an increase in SJ (+1.76 ± 4.05 cm) and CMJ (+1.10 ± 3.20 cm) in the post-test conducted just after the vibration. The values of the post-test performed 30 minutes after the squat jump remained above the ones of pre-test but just below the ones of the immediate post-test (+0.42 ± 4.43 cm). By contrast the values in the counter movement jump drop below the pre-test ones (-0.12 ± 2.45 cm). Based on these data it seems that when the frequency is not high it is necessary to use a greater amplitude in order to achieve the desired effects. The effect achieved after the vibration is transient, not remaining after 30 minutes.

KEYWORDS: Whole body vibrations (WBV), Counter-Movement Jump (CMJ), Squat jump (SJ), Explosive Strength.

Introduction

Whole body vibration (WBV) is nowadays one of the main lines of research due to the multiple possible effects on the body (Cardinale and Bosco, 2003). Some studies have shown how the exposure to low amplitude and high frequency vibration can improve strength, balance and hormonal profile (Cardinale y Bosco, 2003; Kvorning et al., 2006).

The WBV methodology needs to define the characteristics of the vibration, so, it is necessary to define the frequency, amplitude, duration and magnitude used (Luo, McNamara and Moran, 2005). The frequencies used for these exercises ranging from 15 to 44 Hz, while the amplitudes between 3 to 10 mm. The acceleration values ranging from 3.5 to 15 g. With regard to the duration, short exposures, for example 4 to 5 min divided into sets of 1 min with the same rest period between series, are enough to improve muscle strength (Rittweger et al., 2000). With the increments in the length of vibration, the fatigue can appear faster and become more important.

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Longer exposures with this device may trigger the inhibitory feedback (e.g. Golgi complex) or reduce the sensitivity of muscle spindles. In general, people are using intermitent programs for no more than 30 min.
In this way the aim of the study is to know the acute and residual effect (after 30 min.) of one bout with WBV on the explosive strenght assesed by jump test such as counter movement jump (CMJ) and Squat jump (SJ)

Materials and methods

Subjects

Table 1: Descriptive data

GROUP 1	N	Minimun	Maximun	Mean	SD
Age (years)	12	18,00	36,00	22,90	5,06
Weight (Kg)	12	57,30	90,70	72,39	9,46
Height (m)	12	1,65	1,84	1,73	0,06
BMI (kg/m^2)	12	21,05	30,66	24,03	2,63

Procedures

All subjects in the study were invited to three pre-test sessions. The data were correlated in order to obtain the reliability of the (r> 0.85) and we take the third pre-test as baseline. After each intervention one post-test was carried out, analyzing the same parameters in order to identify possible variations between both test. The assesment it was performed just after the vibration and after 30 min in order to determine the residual effect. With regard to the protocol it was used the Galileo Fitness® platform (Novotech, Germany), with a frecuency of 30 Hz and an amplitude of 2.5 mm. The gravity obtained was 9.1 g. The subject remained standing on the platform adopting an isometric position with 110 degrees flexion on the knees. The duration of vibration used for this study was 5 sets of 60 s with another 60 s rest between series.

Every subject performed three CMJ and another three SJ in accordance with the protocol proposed by Cronin & Mali (2000). Each jump was recorded with precision of 0.1 cm. The rest time was 30 s between two consecutive jumps. If the difference between jump's height was more than 5% another attempt was done. The best of the three attemps was recorded. All the jumps were performed on a Ergo Tester ® contact platform (Globus, Italy).

Results

Table 2: Comparation between the data obtained drom the jump's acute effect after the test

Paired analysis		N	Mean	SD	Mean difference	SD	Sig
Pair 1	HSJpre3 (cm)	12	26,13	4,33	+1,76	4,05	0,20
	HSJpostAG1 (cm)	12	27,89	4,63			
Pair 2	HCMJpre3 (cm)	12	34,05	5,38	+1,10	3,20	0,31
	HCMJpostAG1 (cm)	12	35,15	5,15			

HSJpre3: Jump height in SJ from pre-test; HSJpostAG1: Jump height in SJ just after the test; HCMJpre3: Jump height in CMJ from pre-test; HCMJpostAG1: Jump height in CMJ just after the test.

Table 3: Comparation of the data obtained from the residual effect after the jump with the pre-test

GROUP 1		N	Mean	SD	Mean Difference	SD	Sig
Pair 1	HSJpre3 (cm)	12	26,13	4,33	+0,42	4,43	0,77
	HSJpost301 (cm)	12	26,55	4,23			
Pair 2	HCMJpre3 (cm)	12	34,05	5,38	-0,12	2,45	0,88
	HCMJpost301 (cm)	12	33,93	4,93			

HSJpre3: Jump height in SJ from pre-test; HSJpost301: Jump heiht in SJ 30 min after the test; HCMJpre3: Jump heght with CMJ in pre-test; HCMJpost301: Jump height with CMJ 30 min after the test.

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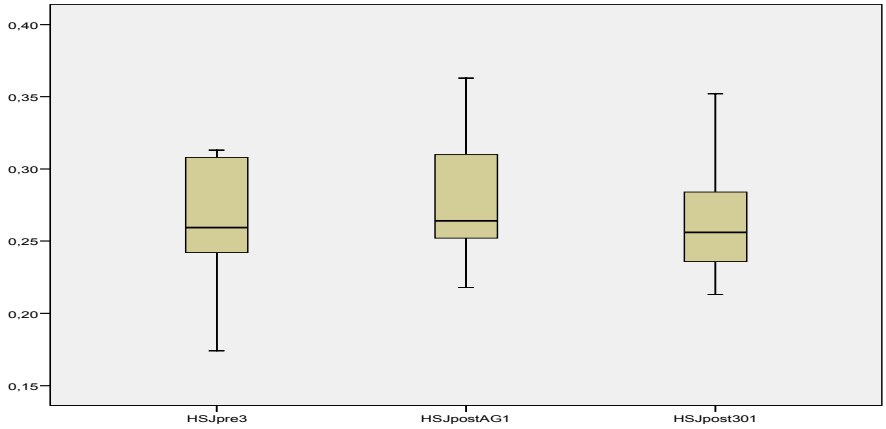

Figure 1. Squat jump height in pre-, post-, and 30 min. after the test
HSJpre3: SJ height in pre-test; HSJpostAG1: SJ height just after test; HSJpost301: SJ height 30 min after the test.

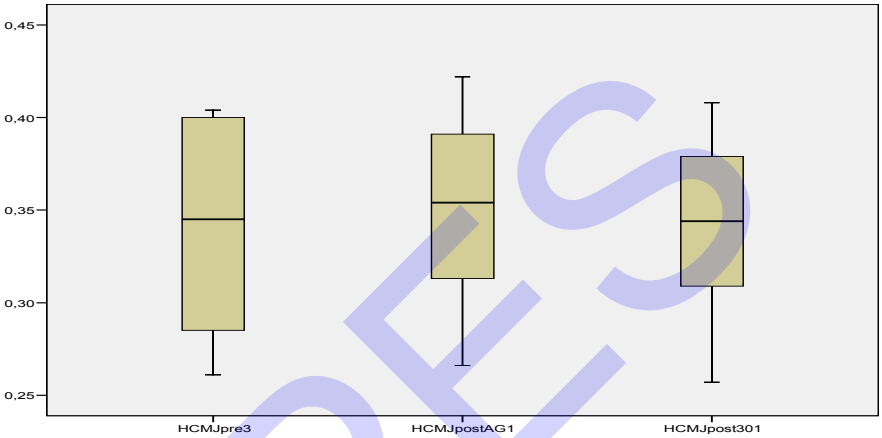

Figure 2. Counter movement jump height in pre-, post--, and 30 min. after the test
HCMJpre3: CMJ height in pre-test; HCMJpostAG1: CMJ height just after test; HCMJpost301: CMJ height 30 min after the test.

Discussion

SJ and CMJ are often used as an index of the explosive strength in the lower limb (Keogh, Weber and Dalton, 2003). Although our results showed a lack of significant effect, we found increments in both test (6.74% and 3.23% in SJ and CMJ height, respectively). Those results are in the line of other previously published (Torvinen et al., 2002a; De Silva et al., 2006; Martínez et al., 2007). Moreover, Cardinale y Lim (2003) studied the effect of WBV on SJ and CMJ jumps in 15 young people participating in recreational sports who underwent a protocol with a 4 mm amplitude and 40 Hz. Data from post-test were lower than those obtained in the pre-test. While the decline observed in SJ was not statistically significant (- 4%, $p = 0.07$) the one in CMJ it was (- 3.8%, $p < 0001$).

It seems therefore, that when the vibration does not produce fatigue and is of short duration it can produce an increase of nervous system signals and facilitate the strength generation (Cardinale and Bosco, 2003). On the other side, when we apply a stressful stimulus it can cause fatigue and then reduce the strength generation. The results suggest that when the frequency is 30 Hz we need a greater amplitude in order to get acute significant improvements in jump ability, whereas when the frequency in greater, it is necessary to use a lower amplitude in order to avoid muscle fatigue.

Regarding the residual effect, some authors suggest that the vibration effect seems to be transitional on the muscle performance (Torvinen et al., 2002). These authors found in their studies that the higher increments founds 2 min after the CMJ were not present 60 min after them (Torvinen et al, 2002). In our case, the residual effect was measured at 30 min, showing an increment for SJ (1.61%) with regard to the pre-test, although just

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6.74% was found in the immediate post-test. The CMJ drop below the pre-test level (- 0.35%). Similar results were observed by several authors (Torvinen et al., 2002; Cormier et al., 2006)

Showed results let us to go further in the study of WBV. In this way, we have seen when the frecuency is not high the amplitude have to be increased in orther to improve the explosive strength. In this way, the improvements found were not maintained after 30 min, so it can be said that the WBV effect is just transitory.

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