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Core Stability Training and Jump Performance in Young Basketball Players

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Abstract: ***The strength core is an important prerequisite to perform sport skills and to perform some everyday activities such as walking, climbing stairs, postural control. The literature, so far, it is mainly dedicated to the description of the effectiveness of core stability exercises in athletes or insedentary adults, with lumbar pain. The study describes the effects of an integrative training of core stabilityon jump performance in young basketball players. In total 44 young basketball players (19 female gender, 25 male gender, age7.07 ± 0.3yrs, height 114, 4 ± 4.3 cm weight 26.8 ± 2.7 kg) participated and were assigned to either an intervention(EG) or a control group (CG). The training program has had a duration of 4 weeks (8 sessions twice a week, for one hour); EG, besides the sports-specific exercises and introduced in the warm up 4 core exercises stability. The strength was evaluated through monopodalic and vertical jump. The results revealed that the 4-week core stability training program improved the left(p<0.05) and right (p<0.001), hop test, the 6m timed hop left and right test (p <0.0005).The CG has obtained statistically significant benefits only in the bipodalic vertical jump (p<0.01). The study confirms the need to introduce integrative core stability exercise, as well as the literature suggests. The study highlighted the functional relationships between core stability and jump performance in prepubertal basketball players.***

Keywords: core stability – injury prevention – jump

1. Introduction

The Core strength is an important precondition for many sports, such as football, basketball, jumping in track and field, to provides a correct posture and to carry out some daily activities such as walking, climbing stairs, downing a step (Granacher et al., 2014; McCurdy et al., 2014; Prieske et al., 2015).

The district of the Core, has the role of controlling and stabilizing the lumbosacral region, and allows as a connection between the upper and lower part of the body (Akuthota et al., 2008; Andorlini, 2013a); this functional unit is able to distribute the forces which are generated by the lower or upper limbs (Andorlini, 2013a,b), as well as demonstrated in soccer training (Shinkle et al., 2012; Afyon, 2014; McCurdy et al., 2014).

To satisfy these two functional requirements, as part of the training methodology, it can identify two different types of training: the core stability tasks have the purpose of control and stability lumbar spine increase; the core strength tasks are intended to allow the transfer of high levels of strength and muscle power, activating local stabilizers and global mobilizers muscles (Faries& Greenwood, 2007; Saeterbakken et al., 2011; Sharrock et al., 2011; Sannicandro, 2014).

So far, the literature has mainly addressed the effectiveness of core stability exercises in athletes or in physically active adults, with special reference to low back pain (Abenhaim et al., 2000; McGill, 2010; Liebenson, 2011) and performance, or to the core training programs effects (Prieske et al., 2016).

To date, in fact, only a study conducted as part of the school physical education classes in prepubertal subjects and aimed to reducing chronic low back pain has described performance increases in trunk muscle strength, after six weeks core training (Allen et al., 2014).

In sports there are very few studies that have described the preventive role of core stability in young (Durall et al., 2009; Hoshikawa et al., 2013; Prieske et al., 2016; Sogut, 2016).

The relationship between the Core stability and sports performance, however, is less clear, and studies are less numerous: it is understood as exercises of Core Stability reduce back pain in sport (Durall et al., 2009; Allen et al., 2014), it may increase balance performance in cross-country skiers (Sato &Mokha, 2009),and performance in the jumping, throwing and sprint (Shinkle et al., 2012).

In the literature there are no studies that have only monitored the core stability training effects;infacttheCore stability exercises have always been associated and integrated with strength lower limb exercises (Reed et al., 2012).

Therefore, an open question remains about what the understanding of the effects on motor performance due only to core stability exercises.

Particularly, mainly because of sedentary childhood lifestyle, it must understand if such types of exercises, that specifically call for a very sensitive target district during this period (Allen et al., 2014), can be advantageous for those prepubescent practicing sport .

The age and motivation to the prepubertal sports should carefully consider the duration of the programs aimed to Core training: they must occupy a limited part of the session, perhaps especially in the initial warm-up, as long suggested in the literature (Faigenbaum et al., 2005).

2. Methodology

This study aimed to describe the effects of an integrative core stability training on jump performance in young basketball players.

The study included 44 young basket players (n=19 female, n=25 male, mean age 7,07±0,3yrs, height 114,4±4,7 cm, weight 26,8±2,7 kg); the sample was divided in Experimental Group (EG, n=21, 11 female, 10 male) and Control Group (CG, n=23, 11female, 12 male).Written informed consent was obtained from all subject.

To assess the lower limbs strength have been used monopodalic jumps:, side hop test, triple hop test and 6 meters timed hop test. The side hop and triple hop provide the jump distance; the 6 meters timed hop test provides evaluates the time spent to reach a distance of 6 meters through fastmonopodalicbounds.To assess the explosive strength was used a Seargent vertical jump.

Descriptive statistics (M ± SD) were calculated for all assessed variables; Student's paired t-test was used to verify the existence of statistically significant differences between the average values obtained. The significance was set at $p < 0.05$.The Effect Size was calculated using Cohen's *d* (Cohen, 1992).

3. Training Procedures

The training program was monitored for 4 weeks, with a total of 8 sessions (biweekly, 1 hour each); EG followed the drills basketball and techniques introduced in the initial warm up 4 core stability exercises (Table 1).

Table 1: Experimental and Control Group training sessions

Group	Session 1	Session 2-5	Session 6-9	Session 10
EG	Evaluation	Core stability (stability condition)	Core stability (instability condition)	Evaluation
CG	Evaluation	Basketball drills	Basketball drills	Evaluation

Four sessions are provided exercises on the ground (stability condition) and four session are provided on unstable surfaces (instability condition); the exercises are described in Table 2.

Table 2: Core stabilty program

Core stability Training Design	Assessment T0	4 session (stabilitycondition)	4 session (instabilitycondition)	Assessment T1
		Plank on the ground 2x10 rip x 3 sec isometric contraction Side plank on the ground 2x8 rip x side x 3sec isometric contraction Side plank (dynamic execution) 2x8 rip x side Mountain climb 3x6 rip x limb	Plank with hands on unstable tools 2x10 rip x 3 sec isometric contraction Side plank static 2x8 rip x 3sec x side with lower limbs on unstable surface Side plank dynamic execution) 2x8 rip x side, with lower limbs on unstable surface Mountain climb 3x6 rip x limb, with lower limbs on unstable surface	

The initial and final assessment were conducted in the two lessons that preceded and followed the 8 training sessions planned. The CG has followed the simple basketball drills and specific sport exercises.

4. Results

The EG obtained significant differences in the pre-post comparison in the side hop left limb (0.05) and right limb (0.001), in left and right 6m timed hop test ($p < 0.0005$). The results of the T-test for independent data show intergroup differences in the post-test (GS vs GC) statistically significant in 6 meters hop ($p < 0.001$, ES: 0:56). The GC showed significant improvements only in vertical jump ($p < 0.01$).

Table 3: Results

	GS			GC		
	T0 M±SD	T1 M±SD	P Value	T0 M±SD	T1 M±SD	P Value
Side Hopleft	36.55±6.327	38.98±5.710	0.046*	38.60±4.940	39.13±5.325	0.207
Side Hopright	37.21±6.512	39.27±5.738	0.001**	39.11±4.881	39.90±4.873	0.068
6M T. H.left	5.822±0.871	4.44±0.936	0.000***	5.134±0.3367	5.187±0.315	0.126
6M T. H. right	5.778±0.766	4.42±0.877	0.000***	5.455±0.633	5.122±0.684	0.919
Triple Hopleft	122.43±7.610	123.79±7.820	0.313	121.77±10.397	122.60±9.629	0.452
Triple Hopright	122.93±10.436	122.67±8.469	0.360	120.83±9.774	120.99±8.949	0.373
Searg	13.77±2.520	14.87±2.642	0.094	13.10±2.513	14.73±2.576	0.006**

Legend: 6M.T.H= &metres Timed-Hop Test; Searg= Seargent Test

5. Discussion

The hypothesis of the study was to evaluate the effects of core stability training on the jump performances in young basketball players.

This is the first study to describe the effects of core stability training on jumping performance in basketball kids. The integrated core stability program was introduced in the warm-up period of each lesson and has provided a difficulty and an intensity increase, from tasks perfomed on the ground and tasks on unstable surfaces. All tasks requiring the trunk control both with the body resting on the ground, with either a tools which gave instability, as indicated in the literature (Faigenbaum et al., 1999; Behm& Anderson, 2006; Hibbs et al., 2008; Granacher et al., 2014; Prieske et al., 2016).

The significant differences obtained in the pre-post comparison test in GS have characterized the monopodalic jump tests, the 6m-timed hop test. The jump performance, with particular reference to those performed in monopodalic, affected by the control of the trunk and pelvis: these districts that confer stability to the extensor musculature of the lower limb and hip, deputed to jump (Hoshikawa et al., 2013).

The results of t-test between the two groups in the post test return in tests of 6m-timed hop test an effect size 0.56, confirming the effectiveness of core stability exercises on jumping tests.

The results of this study are consistent and in line with similar studies that have described the effects of the core trainingon vertical jump performance in young players (Liebenson, 2011; Hoshikawa et al., 2013; Afyon, 2014).

The results obtained in this study, however, disagree with the results of another study that did not identify a significant correlation between core stability performance and sport-specific performance for tennis (Sogut, 2016); the study on young tennis players, however, has only investigated the correlation but not the effects of core stability training.

The values identified in this study, lead to hypothesize that the supplementary program of core stability, however, requires the introduction of additional tasks in the warm up, if you want to get the higher effect size values or significant values in all assessment tests.
The study ultimately confirms the need to assume additional sessions in youth sports destined to strength, as well as the literature suggests already for several years (Faigenbaum et al., 1999, 2005; Kibler et al., 2006).

6. Conclusions

The study highlights the core stability program effectiveness on jump ability in prepubertal basketball players. Today, in prepubertal age, boys and girls more early choose their sport: therefore, sports practice should aim to protect the young practitioners health and to reduce the overloading training risk (Brenner, 2016; Jayanthi&Dugas, 2017). The assessment of these prerequisites in the children must lead the technical and medical staff to consider the advisability of integrative session and exercises in the process of introduction to the sport aimed at reducing the injury risk.

7. Future Scope

Future studies may investigate whether core stability programs can increase speed and endurance performances in prepubertal basketball players.

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