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Examination of the Correlation between Dynamic Balance and Leg Strength of 11 and 12-Year-Old Children Who Have Fencing Training

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Abstract

In this study, it is aimed to examine the relationship between leg strength and dynamic balance of children who have fencing training. 59 epee athletes who are 11 and 12 years old (33 11-year-old, 26 12-year-old) participated in research groups. Star Excursion Balance Test was used to determine balance performances and Baseline brand leg-dynamometer used to determine the leg strength of athletes who had fencing training. First, the Shapiro-Wilk test was used to determine if the data obtained during the study had a normal distribution. Pearson Correlation test was performed for all data displaying a normal distribution. Significance levels were taken as P<0,05 According to the research findings it was determined that there is a meaningful relationship between leg strength and balance test of athletes who have fencing training. As a result, it was seen that balance test values increase as the leg strength increases.

Keywords: Leg strength, Dynamic balance, Star excursion balance test, Epee, Children, Sports

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Contents

1. Introduction

Balance is an important factor in preserving the body composition which is necessary for successful performance in sports. Therefore, it is the basis for dynamic sports which include sudden changes in the pattern of motion especially. All sports contain a certain level of balance (Eler, 1996). Electronic systems (force platforms, stabilimeters, etc.) via which the movements of the body center of gravity projection are examined (Tsigilis *et al.*, 2001; Geldhof *et al.*, 2006) and functional dynamic balance tests such as Y Balance Test (Plisky *et al.*, 2009) Star Excursion Balance Test (Filipa *et al.*, 2010) are used in balance assessment. Since the use of new system measuring equipment is limited in reflecting the balance performance encountered during sports movements, using the functional balance tests in the measurements is also worthful. Star excursion balance test is a test that is commonly used in the literature for dynamic balance and postural control and that has a high fundamental reliability (Hertel *et al.*, 2000; Gribble *et al.*, 2013).

Leg strength is important in fencing branch. For a successful score, factors such as a balanced en garde position, flexibility and leg length are effective rather than lengthening to the opponent with a weapon only (Lavoie *et al.*, 1985). A fencer who finishes his/her attack needs to reach maximum speed at the moment to make his/her move and needs to reach the target with his/her weapon as soon as possible. For this reason, having a good strength is also very important for fencers as well as other features (Gioux *et al.*, 1984). The fatigue that may occur late in the running battle during a fencing game may obstruct to maintain balance especially.

Leg strength is a subject that has been studied frequently in fencing sport (Ntai *et al.*, 2017). Within the scope of studies with leg strength, studies towards the effect of applied training programs, dominant and non-dominant leg strength comparison, differences between elite and non-elite fencers have been carried out (Tsolakis *et al.*, 2010; Tsolakis *et al.*, 2010; Tsolakis and Vagenas, 2010; Tsolakis *et al.*, 2011). Several studies have also been conducted to examine the relationship between lower extremity muscle strength and balance performance. These studies have been applied to different branches (Soyuer and Mirza, 2006; Mohammadi *et al.*, 2012; Celenk *et al.*, 2015; Siriphorn and Chamonchant, 2015; Aktuğ, 2016). Within the scope of studies related to fencing, anthropometric characteristics, variables such as age, sports age have been examined more. We carried out our study to investigate if there is a relationship between balance and leg strength, the two characteristics that are important for fencers.

2. Method

2.1. Participants

Measurements have been taken from 59 11 and 12-year-old epee athletes (33 11-year-old, 26 12-year-old) who have joined the Turkey Super Juniors and Juniors Championships held in the province of Eskisehir in 2017. The athletes, who have been receiving fencing training at least for 1 year and working out at least 3 days a week, have participated in this study in line with the information obtained from their coaches. After initially contacting the Federation, permissions have been taken from Eskişehir provincial representative, who made the organization, and coaches of the participants and then the athletes have joined the measurements voluntarily. During the measurement, the hand of a participant that he/she actively uses has been preferred.

2.2. Measurement Tool

Dynamic balance measurement; Star excursion balance test, which interests lower extremity and measures the dynamic balance of participants, has been used in this study. The test is carried out in eight directions. The test can be used to measure clockwise and anti-clockwise or both sides (Reiman and Manske, 2009). The outmost point that an athlete maintains his/her position for three seconds is recorded in centimeters (Lockie *et al.*, 2013).

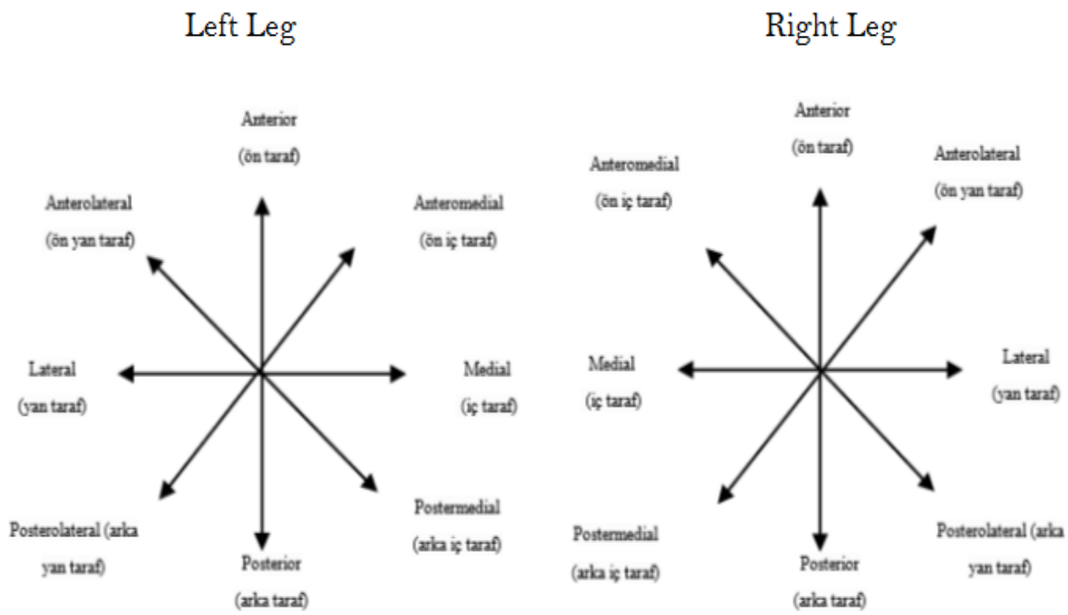
Measurement Of Leg Strength: The measurement was made using Baseline brand leg-dynamometer. Following five minutes of warm-up, after placing their feet on the dynamometer table with their knees bent, the subjects have hove the dynamometer bar, which they have grabbed with their hands, vertically at a maximum using their legs while their arms were stiff, backs were straight and torsos were leaned forward slightly. This heaving has been repeated three times and the best value has been recorded for every subject.

2.3. Application

Athletes have been summoned one by one and taken to the private area prepared for measurement. First, their demographic information was recorded. Following that, star excursion balance test (with both feet) and strength measurement have been carried out respectively. For the star excursion balance test, the athletes have waited unshod in the starting position at the exact center of the star which had been previously fixed to the ground. They have reached out to the outmost point they could with the 45-degree angle for the 8 points which were pre-determined. The proper trial has been regarded as the participant touching the outmost point with a reach out move without unbalancing and coming back to the starting point without unbalancing again. The participant's getting support from the ground during touching or touching a different point with loss of his/her balance has not been considered as a proper trial and the trial has been repeated. For the assessment of one participant, a total of 16 scores, both right and left scores for 8 points, have been recorded considering the average of 3 tries for each direction.

2.4. Analysis

Statistical analysis was performed via SPSS 22 program. Shapiro-Wilk test has been used to determine if the data had a normal distribution. The relationship between leg strength and balance performance values has been analyzed using Pearson for the data that is deemed to have a normal distribution in the test result. Significance level has been taken as $p<0,05$



3. Findings

Table-1. Descriptive Statistics

		Descriptive Statistics		
			Mean	**Std. Deviation**
STAR EXCURSİON BALANCE TEST	RIGHT	**antrerior**	*26,56*	*16,375*
		anterolateral	*52,41*	*20,383*
		lateral	*44,98*	*15,206*
		posterolateral	*51,93*	*16,211*
		posterior	*121,37*	*24,681*
		postermedial	*65,81*	*11,751*
		anteromedial	*66,17*	*18,640*
		medial	*59,37*	*22,995*
	LEFT	**antrerior**	*15,25*	*15,360*
		anteromedial	*67,66*	*13,811*
		medial	*68,05*	*20,077*
		postermedial	*71,66*	*17,670*
		posterior	*123,58*	*24,146*
		posterolateral	*54,83*	*18,302*
		lateral	*50,83*	*12,248*
		anterolateral	*46,14*	*15,964*
THE LEG POWER			*52,43*	*18,793*

Source: Author's field work

Table-2. The Relationship Between Star Excursion Balance Test and Leg Strength

	Leg Strength	
Right Leg Star Excurision Balance	**Pearson Correlation**	**Sig. (2-tailed)**
Antrerior	,290	,026
Anterolateral	,409	,001
Lateral	,369	,004
Posterolateral	,353	,006
Posterior	,428	,001
Postermedial	,683	,000
Anteromedial	,484	,000
Medial	,518	,000
Left Leg Star Excurision Balance		
Antrerior	-,023	,863
Anteromedial	,599	,000
Medial	,649	,000
Postermedial	,626	,000
Posterior	,482	,000
Posterolateral	,454	,000
Lateral	,636	,000
Anterolateral	,423	,001

Source: Calculated from primary data *Level of significance at p<0.05

According to the leg strength and star excursion balance test results, despite the non-existence of a significant relationship in the direction of Anterior Left Foot, it has been founded that there is a significant relationship between star excursion balance test and leg strength in all other parts.

4. Discussion

A sudden and severe forward move is the most characteristical leg move for a fencer. Because each attack develops on the basis of this movement. A forward move made fast and timely is regarded as the core principle of being a successful fencer and this sport (Weineck, 1998). Fencing is a sport which also improves balance by the nature of posture and footwork. Fencers move like they are walking on a thin line and they have to maintain their balances either at high speed or sudden deflections not to be eliminated from the game (Gökmen *et al.*, 1995). Within the scope of our study, it has been noted that there is a positive correlation between balance and leg strength characteristics and balance values increase as the leg strength increases. Studies in different branches seem to support our work. Soyuer and Mirza (2006) have found in their study that there is a relationship between balance and lower extremity muscle strength. Siriphorn and Chamonchant (2015) have stated in their study (2015) that, as a result of the Wii balance exercise that they had applied to the weight-lifters, the balance skill has been improved and the strength of lower extremity muscles has been increased. Mohammadi *et al.* (2012) have found in their study on young male athletes that the leg strength has increased and improvements on dynamic and static balance have occurred following a 6-week strength training toward leg muscles. Soyuer and Mirza (2006) have revealed in their study on subjects with Multiple Sclerosis that a relationship between balance and lower extremity muscle strength is existent. Bressel et al. have mentioned the existence of a relationship between dynamic balance and performance in their study, which was carried out in 2007 (Bressel *et al.*, 2007). Muscles transmit strength with the strength they produce by reaching out to adjacent body parts. These functions of muscles and joints are the basic mechanism that allows the emergence of the movement. A good posture and stability require the coordination of joint positions and movements. Different joints and different muscles, correspondingly, are used to maintain the balance and posture required for the work done (Kunduracıoğlu, 1999). Celenk *et al.* (2015). They have stated that there is a positive correlation between Quadriceps muscle strength and balance performance. Mohammadi *et al.* (2012) have stated that a 6-week strength program has increased leg strength in young athletes, this situation has generated improvements on dynamic and static balance performance. Young *et al.* (2010) have stated that the relationship between lower extremity muscle strength and balance performance might be arising from the emergence of muscle coordination and the increase in motor unit contraction speed. Again, Liman (2008) has explained the positive correlation between strength and balance with the development of inner-muscle and intra-muscles coordination by the increase in muscle strength and this situation increasing synergist and antagonist working capacities of extensor and flexor muscles.

In some of the studies, a meaningful relationship has not been found. In Kurt's study (2015) that was performed with 30 male freestyle wrestlers, who are selected to the national team, a statistically significant difference between leg strengths of weights has been determined where a statistically significant difference between balance results has not been determined in the scope of Freestyle Wrestling. Kapşigay *et al.* (2013) couldn't have detected a statistically significant difference between dominant and non-dominant lower extremity body balance in their study that they have performed on footballers.

As a result, in our study, which was conducted with fencers, it was found that there is a positive correlation between leg strength and balance. It has been revealed that the balance characteristic also improves as the leg strength increases. Looking at the results of studies, that have been conducted on different disciplines, it has been seen that there is a necessity of strength exercises to be included in training programs (Manolopoulos *et al.*, 2004; Asadi *et al.*, 2016). Under the circumstances, the inclusion of specific strength exercises in training programs along with technical tactical practices is recommended to be a good fencer.

5. Limitations and Suggestions

It is thought that there are not enough studies on fencing branch and that the studies related to this field should be increased. The number of samples can be increased.

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