African Educational Research Journal
Vol. 8(2), pp. 147-151, April 2020
DOI: 10.30918/AERJ.82.20.032
ISSN: 2354-2160
Full Length Research Paper

Education of star excursion balance performance among young male athletes

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Accepted 1 April, 2020

ABSTRACT

This study aimed to compare dynamic balance education among young athletes in different sports. So forty male volunteers in soccer (n = 11), handball (n = 6), sprinting (n = 10), and martial arts (n = 13) participated in the current study. The mean age, height, and weight of the participants were 15.7 ± 0.5 years, 175.3 ± 4.6 cm, and 63.0 ± 6.8 kg, respectively, for sprinters; 16.2 ± 0.7 years, 174.2 ± 4.3cm, and 62.2 ± 5 kg, respectively, for martial arts athletes; 16.2 ± 0.8 years, 174.2 ± 6.1 cm, and 61.9 ± 6.0 kg, respectively, for soccer players, 16.3 ± 0.8 years, 180.8 ± 10.5 cm, and 70.7 ± 7.9 kg, respectively, for handball players. Star Excursion Balance was taught 12 sessions for all the participants three days of a week for 1 hour (Lephart et al., 1996). A per-test and post-test of dynamic balance values of both legs were assessed of all participants. and the best scores of each participant were recorded. Normalized leg reach distances (reach distance/leg length x 100 = percentage of leg length) were used as dynamic balance. The SPSS (version 25.0; SPSS Inc, Chicago, IL) was used to analyze the data. On the right leg, the soccer players' reach distances were shorter than of the handball players and martial arts athletes in the MD and PM directions, than of the sprinters in the LAT direction. Similarly, on the left leg, the soccer players had shorter reach distances in the PM and LAT directions when compared with the martial arts athletes, and in the ANT direction when compared with the handball players ($p < 0.05$). It was reported in the current study that SEBT scores of the young soccer players were lower than other athletes. Balance is an important attribute for soccer, like other sports, however leg reach performance which is more related to flexibility may be not initial form for soccer players. Because the soccer-specific motion patterns demanding dynamic balance requirements can be easily performed without flexibility, therefore their postural control ability may be unimproved. On the other side, distinctive dynamic balance control skills of martial arts athletes may be stemmed from their kicking practices. So, it is recommended to teach and practice balance task in all training sessions of whole athletes.

Keywords: Education, postural control, reach distance, star excursion balance test.

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INTRODUCTION

Dynamic balance and postural control are fitness components that affect performance in many sports branches. Training on these skills, athletes aim to improve themselves and gain physical superiority to their competitors. Hence, it is necessary to use the center of gravity together with vestibular, visual, and somatosensory systems to perform dynamic balance effectively (Bhat and Moiz, 2013). In other words dynamic balance is also associated with flexibility besides postural control. If an athlete is not flexible enough to do some branch-specific motion effectively, s/he has to spend extra strength and forced to do that motion or cannot do it. The direct impacts of these performance outputs on each other have been previously reported, especially in team sports where there are different motions such as running, acceleration, jumping, as well as different motoric motions such as ball-free (or with ball) direction changes or throwing-holding-shooting ball (Schneiders et al., 2012; Hrysomallis, 2011).

"Balance" has been measured by many different

methods as an athletic performance variable and many different methods have been developed to measure it. Although it is possible to accept some methods utilized with force platforms as the gold standard, especially for static balance performance (Riemann et al., 1999). It is not the case for dynamic balance. Among many different methods, the Star Excursion Balance Test has been addressed differently since it requires both flexibility and force (Hrysomallis, 2011), so that such a measurement method has been reported to be a reliable method for assessing dynamic balance (Bhat and Moiz, 2013). Studies have shown that even the risk of injury to athletes can be estimated based on the results of such tests (Plisky et al., 2006). In addition to the effects of balance on injury risk analysis or athletic performance, the studies have examined the difference in development by the branch-specific motions. For example, as in soccer, motions such as kicking the ball to shoot or to pass the ball by standing on the single leg are directly related to such dynamic performance components (Paillard et al., 2006).

Improving balance has shown a lot of promise in being able to prevent injuries for a wide range of people. For athletes, balance work is associated with a dramatically lower risk of injury. Just one sprained ankle can alter your season and will predispose you to future ankle sprains for life, but regular balance work can decrease your risk of a sprain by nearly 40 perecent. For the elderly, improved balance could prevent a fall, which is the cause of over 90 percent of all hip fractures–one of people's most life-altering (and shortening) injuries. It is thought it is pretty obvious that the potential benefits of working on balance will greatly outweigh the small time investment on all part (Plisky et al., 2006). It is also the case for other team sports such as basketball, volleyball, and handball, which include physical activities at high intensities as in soccer. The reason why hockey players also have high dynamic balance skills is that they have to do their running actions with the ball (disc) and the skills they acquire after such repetitive motions are directly related to dynamic balance (Bhat and Moiz, 2013). Considering that the motions in such team sports can overlap with the motions in some individual sports, it was thought that the differences in dynamic balance elements by the branches should be examined more. Therefore, our study aimed to compare the Star Excursion Balance Test results of the athletes attending the same sports high school and training in soccer, handball, sprinting, and martial arts.

MATERIALS AND METHODS

Participants

In this study, a total of 40 young male athletes (10 sprinters, 13 martial arts athletes, 11 soccer players, and 6 handball players) aged 15 to 17 attending the same sports high school voluntarily participated in this study. The participants were informed about the test procedure one day before the measurements and that the tests administered did not pose any health risks.

Procedure

The Star Excursion Balance Test (SEBT) was taught 12 sessions for all the participants three days of a week for 1 hour by a same teacher. The SEBT requires the individual to maintain body stability by standing on the single leg (support leg), to reach the maximum position in different directions with the help of the other leg, and to return to the first position. A per-test and post-test of dynamic balance values of both legs were assessed of all participants. The participants were asked to reach the lines, the last points they are able to reach, in eight different directions (anterior, posterior, medial, lateral, anterior medial, anterior lateral, posterior medial, and posterior lateral) (Figure 1). During the test, the participants were required to return to the starting position in the center without distorting the support leg when tapping the reach point. The maximum reach distance was determined as the distance reached by the reaching leg at the last point. The test was terminated and re-administered once the participant lifted its support leg, moved it away from the center point, or stepped on the point where it should have tapped. Each participant was given 3 attempts to tap on 8 pre-determined lines with both legs. Each participant started the test with the right leg in the center and took a 5-minute break at the end of 3 attempts. Then, 3 more attempts were done with the other leg (Gribble et al., 2012).

The best value from the data obtained in the SEBT was recorded at per-test and post-test in cm. The balance performance values of the participants were normalized according to the leg length of them. Normalization was done by dividing the reach distance to each direction by the leg length of the participant, and then multiplying the outcome by 100 (Gribble and Hertel, 2009).

Normalized score (cm) = Reach distance (cm) / leg length (cm) × 100.

Data analysis

The data obtained were analyzed with the SPSS for windows release 21.0 (Statistical Package for Social Sciences Inc. Chicago, IL, USA). In the analysis of the data, the data set was examined primarily in terms of erroneous value, outlier value, and normality of the distribution. The normality of the distribution was analyzed by the Shapiro Wilk test and it was concluded that the distribution was normal ($p > 0.05$). In the present

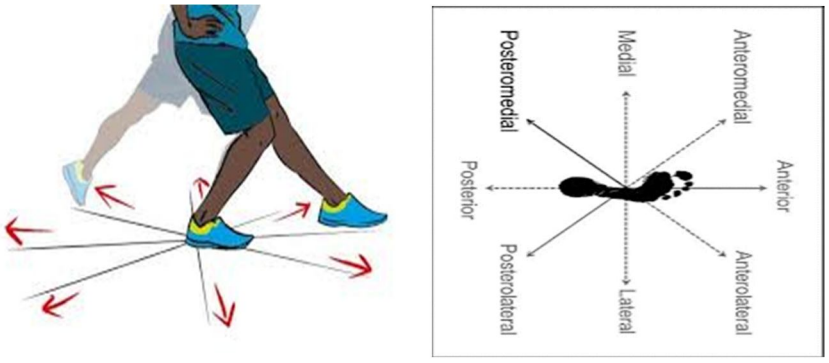

Figure 1. The Star Excursion Balance Test (SEBT).

study, the variables determined by measurement were indicated as mean (**X**) and standard deviation (S). Independent Samples T-Test was used to compare the balance performance of young male athletes training in soccer, handball, sprinting, and martial arts. In all statistics, p significance value was taken as n = 0.05.

RESULTS

Age, height, and weight values of the athletes participating in the study are given in Table 1.

In terms of demographic characteristics, a statistically significant difference was observed between soccer players and handball players by the weight variable. However, such a difference was not considered since the dependent variable (balance) is not a force parameter and such difference is due to height (standardized data by the leg length was considered).

As shown in Table 2, it was observed that the reach distances of the soccer players on the right leg were shorter than of the martial arts athletes and handball players in the MD and PM directions than of the sprinters in the LAT direction ($p < 0.05$). Other differences were not statistically significant ($p > 0.05$).

On the other hand, it was found out that reach distances of the soccer players on the left leg were shorter than of the martial arts athletes in the PM and LAT directions, and that of the handball players in the AL direction ($p < 0.05$) (Table 3).

Table 1. Demographic characteristics.

Group	n	Age	Height	Weight
Soccer	11	16.2 ± 0.8	174.2 ± 6.1	61.9 ± 6.0
Handball	6	16.3 ± 0.8	180.8 ± 10.5	70.7 ± 7.9*
Sprinting	10	15.7 ± 0.5	175.3 ± 4.6	63.0 ± 6.8
Martial Arts	13	16.2 ± 0.7	174.2 ± 4.3	62.2 ± 5

DISCUSSION AND CONCLUSION

It has been demonstrated by studies that postural control and dynamic balance are required for optimum performance in daily life and sports activities (Cote et al., 2005). Although it was initially thought that there might be differences in the dynamic balance values of the sports branches, it was not anticipated that soccer players would have the lowest values in all parameters where significant differences were found.

The fact that previous studies used different dynamic balance methods and that those conducted with the methods of our study (the SEBT) used different techniques (such as normalized scores, non-normalized scores) make it difficult to perform a comparison. However, it is clear that there is no commonality in the related literature. While some of the studies show that athletes will have the highest dynamic balance values in sports branches, such as gymnastics requiring both balance and flexibility performance (Davlin, 2004), some suggest that gymnastics athletes may even be similar to others in terms of dynamic balance (Vuillerme and Nougier, 2004; Bressel et al., 2007), and some studies revealed that there was no statistically significant difference between athletes and healthy individuals in the balance performance results on the right-left leg or dominant-non-dominant leg (Lin et al., 2009; Kapşigay et al., 2013; Mccurdy and Langford, 2006; Greve et al.,

Table 2. Normalized SEBT values for the right leg.

Group	Test	ANT	AM	MD	PM	PO	PL	LAT	AL
Soccer	Pre	92.5 ± 2.0	93.5 ± 3.2	90.3 ± 3.1	90.5 ± 3.6	101.5 ± 11.7	86.1 ± 5.2	80.0 ± 2.1	87.0 ± 5.0
	Post	94.5 ± 3.0	95.7 ± 3.4	91.3 ± 4.2	91.9 ± 4.7	102.7 ± 12.6	88.2 ± 7.2	80.6 ± 5.6	88.0 ± 6.0
	P value	0.065	0.067	0.055	0.057	0.063	0.052	0.058	0.059
Handball	Pre	96.6 ± 3.2	95.4 ± 4.7	90.2 ± 6.0	95.0 ± 4.0	102.2 ± 6.4	94.3 ± 4.8	85.5 ± 5.4	91.8 ± 4.9
	Post	98.6 ± 4.5	96.2 ± 5.8	97.5 ± 3.0*	101.0 ± 5.0*	102.2 ± 6.4	94.3 ± 4.8	85.5 ± 5.4	91.8 ± 4.9
	P value	0.053	0.051	0.36	0.044	0.054	0.057	0.055	0.52
Sprinting	Pre	95.6 ± 2.1	94.4 ± 2.5	94.6 ± 3.9	96.3 ± 5.2	96.9 ± 8.6	93.0 ± 5.8	82.6 ± 3.2	87.7 ± 6.9
	Post	96.7 ± 2.6	96.4 ± 2.9	95.7 ± 4.0	97.3 ± 6.3	98.4 ± 6.5	94.0 ± 6.8	89.6 ± 5.2*	88.4 ± 7.8
	P value	0.066	0.057	0.061	0.053	0.059	0.061	0.004	0.053
Martial Arts	Pre	95.3 ± 6.8	95.2 ± 7.6	93.3 ± 4.6	95.3 ± 5.5	98.9 ± 7.8	92.8 ± 7.7	83.5 ± 6.5	90.6 ± 4.7
	Post	96.3 ± 5.8	96.2 ± 3.6	97.3 ± 5.4*	100.3 ± 6.5*	99.9 ± 6.8	93.7 ± 7.8	84.2 ± 6.3	91.8 ± 4.9
	P value	0.052	0.54	0.039	0.017	0.58	0.059	0.061	0.052

AL: Anterolateral, ANT: Anterior, AM: Anteromedial, MD: Medial, PM: Posteromedial, PO: Posterior, PL: Posterolateral and LAT: Lateral. *statistically more than the values of soccer players in the same direction ($p<0.05$).

Table 3. Normalized SEBT values for the right leg.

Group	Test	ANT	AM	MD	PM	PO	PL	LAT	AL
Soccer	Pre	92.7 ± 5.4	94.0 ± 4.4	93.5 ± 6.5	93.7 ± 7.6	93.1 ± 8.6	90.4 ± 2.7	77.9 ± 8.6	87.65 ± 3.9
	Post	93.7 ± 6.4	95.0 ± 4.7	94.5 ± 3.8	95.1 ± 6.0	94.9 ± 5.7	91.3 ± 5.1	79.8 ± 6.8	88.0 ± 4.7
	P value	0.056	0.55	0.061	0.054	0.54	0.058	0.063	0.056
Handball	Pre	96.6 ± 5.3	96.7 ± 4.6	96.5 ± 5.9	98.9 ± 7.6	98.9 ± 7.7	94.3 ± 7.9	82.9 ± 7.9	93.5 ± 5.6
	Post	97.0 ± 6.4	97.8 ± 5.6	97.2 ± 6.5	99.4 ± 3.8	100.9 ± 5.5	95.1 ± 4.9	83.9 ± 8.9	94.8 ± 6.5*
	P value	0.053	0.051	0.66	0.054	0.054	0.057	0.055	0.52
Sprinting	Pre	93.4 ± 6.5	95.8 ± 5.7	94.1 ± 8.5	97.5 ± 7.9	97.4 ± 8.8	89.5 ± 2.6	84.6 ± 6.6	85.9 ± 2.1
	Post	94.3 ± 4.5	97.2 ± 4.9	95.7 ± 6.2	99.5 ± 6.0	98.2 ± 5.6	91.4 ± 4.8	85.3 ± 5.2	88.7 ± 4.7
	P value	0.053	0.051	0.66	0.064	0.055	0.056	0.052	0.52
Martial Arts	Pre	94.8 ± 1.1	95.5 ± 2.6	95.8 ± 4.5	100.1 ± 41	99.0 ± 5.9	96.4 ± 5.3	86.4 ± 4.9	88.5 ± 4.6
	Post	95.4 ± 7.1	96.5 ± 4.2	97.1 ± 5.7	101.8 ± 5.4*	100.0 ± 6.9	97.9 ± 9.6	87.8 ± 7.8*	90.7 ± 3.2
	P value	0.052	0.54	0.55	0.045	0.60	0.57	0.037	0.63

AL: Anterolateral, ANT: Anterior, AM: Anteromedial, MD: Medial, PM: Posteromedial, PO: Posterior, PL: Posterolateral and LAT: Lateral. *statistically more than the values of soccer players in the same direction ($p<0.05$).

2007). In a few studies involving soccer players to compare dynamic balance, the low reach distance of soccer players that will make such a clear difference has not been reported. Such a difference is thought to be due to gender, age, or player position (Davlin, 2004). Apart from these, another limitation is the fact that physical differences among soccer players are higher than among sprinters and martial arts athletes. In terms of the positions in the soccer, while the players in the center-back positions can be physically bulkier, the midfield players are shorter, and the wingers are faster. On the other hand, martial arts is not only a foot game to beat the opponent but also requires sportive performance and control, such as high endurance, strength, flexibility, speed, quickness, balance, reaction, and strategy (Yoon, 2002). Therefore, athletes in each sports branch are required to exhibit unique performance indicators. Challenging muscle groups to work together in ways that they have not had to before can lead to improved control of muscle groups that may have been dormant from years of sitting and leaning. Learning (or re-learning) how to use muscles synergistically can improve posture and

strength, which can have several health benefits including a reduced chance of getting arthritis, back pain, or other health issues (Mccurdy and Langford, 2006).

Although it is not possible to evaluate each player position separately, it is recommended for the future studies to consider such a point of view with more sample groups. Besides these limitations, the study findings revealed that the dynamic balance performance of young male soccer players was lower than of handball players, sprinters, or martial arts athletes. So it is recommended to teach and practice balance task in all training sessions of whole athletes.

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Citation: Adigüzel, N. S. (2020). Education of star excursion balance performance among young male athletes. African Educational Research Journal, 8(2): 147-151.