

ESTABLISHING THE RELATIONSHIP OF STATIC AND DYNAMIC BALANCE PARAMETERS IN 10-12-YEAR-OLD SOCCER PLAYERS

B. OPREA¹ L.E. MIHAILESCU² F. COJANU²

Abstract: *The aim of the paper is to establish the relationship between static and dynamic balance parameters in young soccer players aged 10-12. **Methods.** An exploratory study was organized with a group of 10-12-year-old soccer players of the School Sports Club no. 1 of Bucharest. The bipedal balance was assessed using the Sensamove Mini Board. The relationship of the static and dynamic balance parameters was determined with the Pearson's correlation coefficient. Tests applied: Test 1 - static balance (SB), Test 2 – lateral dynamic balance (LDB) and Test 3 - vertical dynamic balance (VDB). Measured parameters: performance, front and back inside (LDB), left and right inside (VDB), left and right avg. deviation. The assessment results highlighted the level of balance development in 10-12-year-old soccer players and the correlations between their parameters.*

Key words: *performance, inside, deviation, correlation analysis*

1. Introduction

Every aspect of physical and technical development is essential in youth soccer [1] and both static and dynamic balance play a crucial role in the performance of players [3]. However, the relationship between these parameters in 10 – 12-year-old soccer players is still underexplored. This research aims to investigate this relationship to better understand the physical and technical development of these players during the critical transition period to competitive soccer.

Research has investigated the influence of early soccer training on postural control in young players [4], [5], [18]. It has been found that they exhibit improved stability and less dependence on vision compared to non-athletes. Additionally, it has been highlighted that the postural control of soccer players is influenced by general motor coordination. Their level of athleticism is associated with superior performance in maintaining body balance [2], [10], [11], [16].

By examining and assessing the parameters of static and dynamic balance,

¹ Doctoral School of Sport Sciences and Physical Education, National University of Science and Technology Politehnica Bucharest, University Center Pitesti, Romania; bogdan4842@gmail.com

² Department of Physical Education and Sport, National University of Science and Technology Politehnica Bucharest, University Center Pitesti, Romania.

the aim is to identify possible correlations and interdependencies between these ones [15], [17]. Understanding this relationship could provide coaches and sports specialists with a clearer perspective on the development of young soccer players and could serve as a basis for developing more efficient and personalized training programs [7], [19].

Therefore, this research intends to make a significant contribution to the field of sports science, focusing on an essential aspect of the development of young soccer players and providing a solid foundation for optimizing their training and performance during competitions.

2. Method

The study involved a group of 25 soccer players aged 10-12 from School Sports Club No. 1 in Bucharest. Parental consent was obtained and signed in accordance with the Helsinki Declaration before the research started. The study was approved by the Ethics Committee of the Doctoral School of Sport Science and Physical Education (ID: 11/22.01.2024), University Center Piteşti, Romania.

For assessing bipedal balance, the Sensamove Mini Board platform was utilized. The following tests were administered: Test 1 - static balance (SB), Test 2 - lateral dynamic balance (LDB), and Test 3 - vertical dynamic balance (VDB). The measured parameters included performance, front and back inside (LDB), left and right inside (VDB), and left and right average deviation.

The statistical indicators were calculated using the KyPlot 6.0 software (KyensLab Inc). The analysis of the relationship between the measured indices was conducted using the Pearson correlation coefficient. Statistical significance was established at $p < 0.05$.

3. Results

The relationship between static and dynamic balance parameters in young soccer players aged 10-12 was established by calculating descriptive statistical indices (Tables 1-3) and conducting Pearson's linear correlation analysis (Figure 1, A and B).

Descriptive statistics

Table 1

Variables	Mean \pm SD	CV (%)	Confidence Level of Mean (0.95)	Confidence Limit of Mean	
				Lower	Upper
Performance (%)	76.36 \pm 11.7	15.34	4.83	71.5	81.2
Front. avg. deviation (degrees)	1.55 \pm 0.97	63.19	0.40	1.14	1.95
Back, avg. deviation (degrees)	-1.53 \pm 0.84	-54.9	0.35	-1.87	-0.91
Left, avg. deviation (degrees)	-1.28 \pm 0.89	-69.5	0.37	-1.64	-0.91
Right, avg. deviation (degrees)	1.28 \pm 0.77	60.00	0.32	0.96	1.60

Descriptive statistics

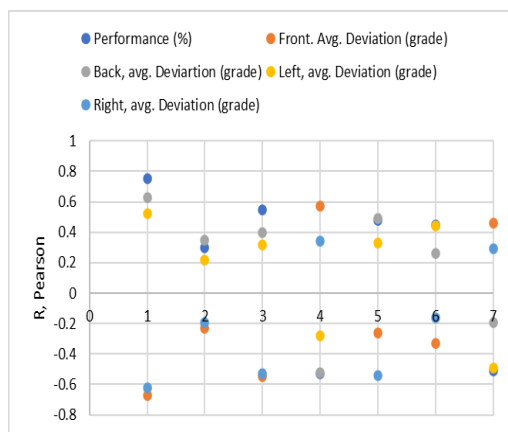
Table 2

Variables	Mean ± SD	CV (%)	Confidence Level of Mean (0.95)	Confidence Limit of Mean	
				Lower	Upper
Performance (%)	72.48 ± 14.85	20.49	6.13	66.35	78.61
Front, inside (%)	31.36 ± 12.22	38.98	5.04	26.31	36.41
Back, inside (%)	40.08 ± 12.51	31.22	5.16	34.91	45.24
Front. avg. deviation (degrees)	1.75 ± 0.77	43.76	0.31	1.43	2.07
Back, avg. deviation (degrees)	-1.90 ± 0.57	-30.44	0.24	-2.14	-1.66
Left, avg. deviation (degrees)	-4.21 ± 1.39	-33.04	0.57	-4.78	-3.63
Right, avg. deviation (degrees)	3.63 ± 1.56	42.88	0.64	2.99	4.28

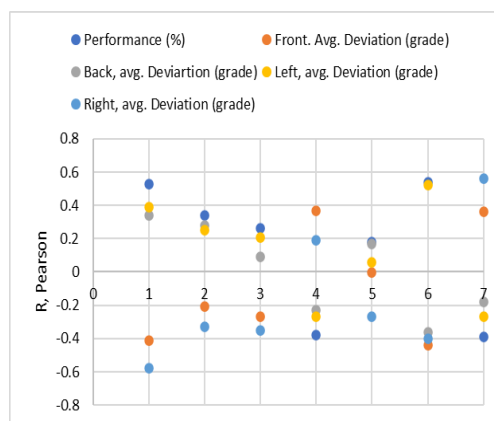
Descriptive statistics

Table 3

Variables	Mean ± SD	CV (%)	Confidence Level of Mean (0.95)	Confidence Limit of Mean	
				Lower	Upper
Performance (%)	79.56 ± 17.98	22.60	7.42	72.14	86.98
Left, inside (%)	41.52 ± 16.43	39.57	6.78	34.73	48.30
Right, inside (%)	37.96 ± 14.41	37.96	5.95	32.01	43.91
Front. avg. deviation (degrees)	3.50 ± 0.91	26.01	0.37	3.13	3.88
Back, avg. deviation (degrees)	-3.91 ± 1.30	-33.28	0.54	-4.45	-3.37
Left, avg. deviation (degrees)	-1.45 ± 0.67	-46.43	0.27	-1.73	-1.18
Right, avg. deviation (degrees)	1.57 ± 0.82	52.4	0.34	1.23	1.91



A. SB – LDB



B. SB - VDB

Fig. 1. Linear correlation analysis

The comparative results between the evaluated test parameters reveal better performances in VDB (79.56%) and left inside (41.52%). There are smaller differences in the front and back average deviation in SB (1.55 and -1.53 degrees) and left and right average deviation in VDB (-1.28 and 1.28 degrees). Regarding the differences between the Confidence Limit of Mean (Lower & Upper), smaller intervals are observed in the performance of 9.7% (SB), inside in LDB of 10.1% and 10.3%, average deviation in front-back in LDB (0.64 and -0.48 degrees), and left-right in VDB (-0.55 and 0.68 degrees).

The correlation analysis between SB parameters with LDB and VDB reveals strong correlations of 42.8% (5.7% at $p < 0.001$, 20% at $p < 0.01$, and 17.1% at $p < 0.05$), along with weak correlations with front, inside (LDB), and left and back inside (VDB), as well as back average deviation.

4. Discussions

Some studies investigated the impact of early soccer training on postural control in 13-year-old boys, demonstrating significant improvements in the stability and postural control of soccer players compared to non-athletes. It was suggested that football training can enhance postural control among youth and that athletic level directly influences body balance and balance recovery strategies in professional and junior elite soccer players [1], [2], [10].

The studies of John et al. [11] and Pau, M., Ibba, G. [16] focused on the biological maturation influence on postural control in adolescent soccer players. They highlighted a significant correlation between this maturation and the scores of

BESS (Balance Error Scoring System) and the reach directions of YBT (Y-Balance Test) too. Thus, there were identified an increased risk of injury during the adolescent growth period and important differences in postural balance depending on age and playing position. Also, the paper of Pau, M., Porta, M. [17] revealed that young national-level soccer players demonstrated better balance performance after a forward jump compared to regional-level players, without significant differences in static balance tests.

Some specialists compared static and dynamic balance among collegiate athletes in soccer, basketball, and gymnastics. They highlighted notable differences between sports, showing that gymnasts had the best performance [3]. At the same time, the studies assess the importance of balance in performance and injury prevention in soccer players. In order to reach a comprehensive understanding, it is necessary to assess both static and dynamic balance [9]. In the case of elite soccer players, the conclusions suggest that balance assessment should also include both static and dynamic tests [15]. Additionally, it was studied the association between muscle strength, balance and mobility in healthy children. It was concluded that performance in these areas is task-specific and requires different evaluation and training approaches [13]. Finally, the analysis of balance differences between limbs in young football players indicates an increased risk of injury in those with notable limb imbalances [14].

The studies also investigate the impact of additional balance training programs on technical skills and performance in young soccer players, demonstrating that

balance training can improve technical skills and physical performance in their case [4], [5]. Furthermore, the specialists highlight the importance of balance training in the development of young athletes and the need for further research to understand the mechanisms involved in improving balance in various sports and at different ages [18].

Regarding the relationships between sprinting, jumping, balance and change of direction in young soccer players, the results suggest that sprinting and jumping significantly contribute to performance in change of direction [7]. As for the correlation between the results of dynamic tests on a stabilometric platform and the Y-Balance test results in adolescent athletes, an important correlation was found only for the posterior-medial direction [19].

5. Conclusions

Performance in balance tests, especially in the VDB and left inside parameters, is significantly better in young soccer players aged 10 to 12.

The smaller differences observed in the front and back average deviation for SB, as well as the left and right average deviation for VDB, suggests greater uniformity in postural control among young soccer players at these ages. This fact can be beneficial for athletic performance and injury prevention.

Correlation analysis reveals strong connections between certain balance parameters, with significant association at various confidence levels, suggesting that these parameters are interdependent and can be used to assess and monitor balance development in young soccer players.

Acknowledgments

This paper is part of the research theme within the Doctoral School of Sport Sciences and Physical Education within the University Center of Pitești. We express our gratitude to the director of CSS No.1 Bucharest, Romania, and to the athletes who participated in this research.

References

1. Bieć, E., Kuczyński, M.: *Postural control in 13-year-old soccer players*. In: *European journal of applied physiology*, 110, 2010, p. 703-708.
2. Bigoni, M., Turati, M., Gandolla, M., et al.: *Balance in young male soccer players: dominant versus non-dominant leg*. In: *Sport Sciences for Health*, Vol. 13, 2017, p. 253-258.
3. Bressel, E., Yonker, J.C., Kras, J., et al.: *Comparison of static and dynamic balance in female collegiate soccer, basketball, and gymnastics athletes*. In: *Journal of athletic training*, 42(1), 2007, p. 42.
4. Cè, E., Longo, S., Paleari, E., et al.: *Evidence of balance training-induced improvement in soccer-specific skills in U11 soccer players*. In: *Scandinavian journal of medicine & science in sports*, 28(11), 2018, p. 2443-2456. DOI:10.1111/sms.13240.
5. Cerrah, A.O., Bayram, İ., Yildizer, G., et al.: *Effects of functional balance training on static and dynamic balance performance of adolescent soccer players*. In: *International Journal of Sport Exercise and Training Sciences-IJSETS*, 2(2), 2016, p. 73-81.
6. Chtara, M., Rouissi, M., Bragazzi, N. L., et al.: *Dynamic balance ability in young elite soccer players: implication of isometric strength*. In: *J Sports Med Phys Fitness*, 58(4), 2018, p. 414-420.

7. Falces-Prieto, M., González-Fernández, F.T., et al.: *Relationship between sprint, jump, dynamic balance with the change of direction on young soccer players' performance*. In: Scientific Reports, 12(1), 2022, p.12272.
8. Hammami, R., Granacher, U., Pizzolato, F., et al.: *Associations between Change of Direction, Balance, Speed, and Muscle Power in Prepubescent Soccer Players*. In: Journal of Athletic Enhancement 6: 6 of, 6, 2, 2017.
9. Hrysomallis, C., McLaughlin, P., Goodman, C.: *Relationship between static and dynamic balance tests among elite Australian Footballers*. In: Journal of science and medicine in sport, 9(4), 2006, p. 288-291.
10. Jadczyk, L., Grygorowicz, M., Dzudzinski, W.: *Comparison of static and dynamic balance at different levels of sport competition in professional and junior elite soccer players*. In: The Journal of Strength & Conditioning Research, 33(12), 2019, p. 3384-3391.
11. John, C., Rahlf, A.L., Hamacher, D., et al.: *Influence of biological maturity on static and dynamic postural control among male youth soccer players*. In: Gait & posture, Vol. 68, 2019, p. 18-22. DOI:10.1016/j.gaitpost.2018.10.036
12. Kartal, A.: *The relationships between dynamic balance and sprint, flexibility, strength, jump in junior soccer players*. In: Pedagogy of Physical Culture and Sports, 24(6), 2020, p. 285-289.
13. Muehlbauer, T., Besemer, C., Wehrle, A., et al.: *Relationship between strength, balance and mobility in children aged 7–10 years*. In: Gait & posture, 37(1), 2013, p. 108-112.
14. Muehlbauer, T., Schwiertz, G., Brueckner, D., et al.: *Limb differences in unipedal balance performance in young male soccer players with different ages*. In: Sports, 7(1), 2019, p. 20.
15. Pau, M., Arippa, F., Leban, B., et al.: *Relationship between static and dynamic balance abilities in Italian professional and youth league soccer players*. In: Physical Therapy in Sport, 16(3), 2015, p. 236-241. DOI:10.1016/j.ptsp.2014.12.003.
16. Pau, M., Ibba, G., Leban, B., et al.: *Characterization of static balance abilities in elite soccer players by playing position and age*. In: Research in sports medicine, 22(4), 2014, p. 355-367.
17. Pau, M., Porta, M., Arippa, F., et al.: *Dynamic postural stability, is associated with competitive level, in youth league soccer players*. In: Physical Therapy in Sport, 35, 2019, p. 36-41. DOI: 10.1016/j.ptsp.2018.11.002.
18. Ricotti, L. *Static and dynamic balance in young athletes*. In: Journal of human sport and exercise, 6(4), 2011, p. 616-628.
19. Sikora, D., Pałac, M., Myśliwiec, A., et al.: *Assessment of the relationship between Y-balance test and stabilometric parameters in youth footballers*. In: BioMed Research International, 2020.