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

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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,

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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 Pitești, 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

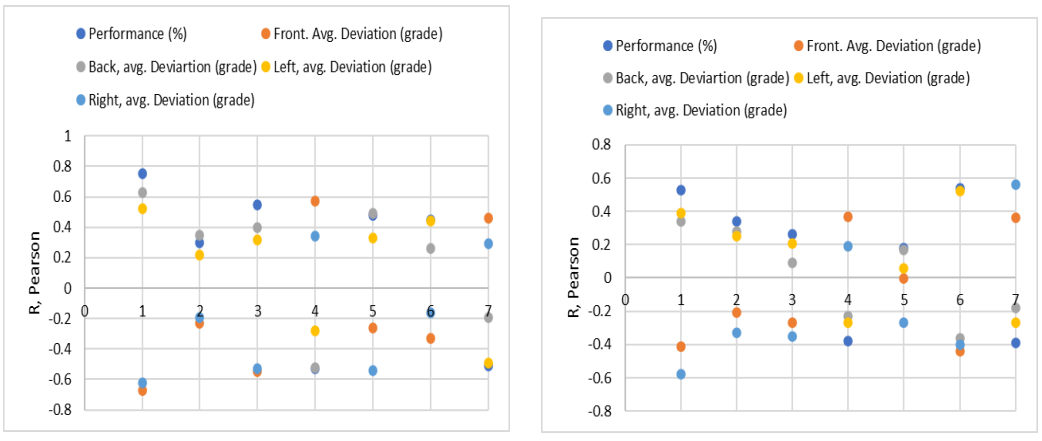
Variables	Mean ± SD	CV (%)	Confidence Level of Mean (0.95)	Confidence Limit of Mean	
				Lower	Upper
Performance (%)	76.36 ± 11.7	15.34	4.83	71.5	81.2
Front. avg. deviation (degrees)	1.55 ± 0.97	63.19	0.40	1.14	1.95
Back, avg. deviation (degrees)	-1.53 ± 0.84	-54.9	0.35	-1.87	-0.91
Left, avg. deviation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

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