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The Relationship between Dynamic Balance and Soccer Passing Ability among University Level Soccer Players

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Abstract

Dynamic balance is essential in soccer, aiding stability during movements like dribbling and passing. Since passing is critical for maintaining possession and facilitating team play, it may be influenced by a player's balance control. The objective of this study was to examine the relationship between dynamic balance and soccer passing ability among soccer players and to assess performance across different playing positions. Thirty-four university-level soccer players (N=34, Age: 19.9 ± 1.2 years; Weight: 67.6 ± 6.7 kg; Height: 1.73 ± 5.1 m) volunteered to participate. Players were categorized into forward (N=11), defender (N=11), and midfielder (N=12). Dynamic balance was evaluated using the Johnson Modification Dynamic Balance Test (JMBT), while soccer passing ability was assessed using the Loughborough Soccer Passing Test (LSPT). Pearson correlation analysis revealed a significant positive correlation between dynamic balance and soccer passing ability ($r = 0.77$, $P < 0.05$) suggesting players with good balance demonstrated better passing accuracy. However, no significant differences in dynamic balance and passing performances were found across playing positions ($P > 0.05$). These findings highlight the potential benefits of incorporating balance training into soccer conditioning programs to enhance technical skills such as passing. Further research is recommended to explore the effects of long-term balance training interventions on various soccer skills across different levels of play. At this point, it can be concluded that there is a significant relationship between dynamic balance and soccer passing ability in soccer players.

Keywords: *Football, youth, dynamic balance, balance test, performance, soccer skills*

Introduction

Soccer, also referred to internationally as football, is a dynamic and high-intensity sport that requires players to execute a range of technical skills under varying degrees of physical and psychological stress (Atan, Azli, Jakiwa, & Rustam, 2023; Carling, Williams, & Reilly, 2005). Among these skills, passing is a fundamental component essential for maintaining possession, creating scoring opportunities, and implementing team strategies (Galang, Qowiyyuridho, Tomoliyus, & Fauzi, 2021). The execution of effective passes not only necessitates technical proficiency but is also influenced by physical attributes such as balance. Balance is a fundamental component of motor skill-related fitness and is significantly associated with athletic performance across multiple sports disciplines. Existing literature in sports science has provided evidence of the correlation between balance and performance, including its role in injury prevention (Al Attar et al., 2022). However, despite the recognized importance of balance in athletic performance, the specific relationship between dynamic balance and passing ability in soccer remains an area of limited empirical investigation.

Balance is generally classified into two primary categories: static and dynamic. Static balance refers to the ability to maintain an upright or stable position while stationary, such as stand-

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ing still or holding a specific posture (Haddad, 2024). In soccer, static balance is crucial for maintaining stability during one-legged stances, which frequently occur when players prepare for kicks or change direction (Przysucha et al., 2024; Sinulingga et al., 2024). Additionally, it plays a vital role in preventing falls and ensuring stability during stationary activities, including defensive maneuvers and ball control (Chiarovano et al., 2015). Previous research has demonstrated a significant association between static balance and neuromuscular parameters such as trunk endurance and strength (Babagoltabar & Norasteh, 2024). Moreover, studies suggest that goalkeepers exhibit superior static balance compared to players in other positions, indicating that position-specific demands influence balance performance (Mahmoudi et al., 2023). While static balance is essential for soccer performance, particularly for goalkeepers, dynamic balance also plays a fundamental role in overall athletic capability. Given the fast-paced and continuously evolving nature of soccer, dynamic balance is often considered more critical than static balance. However, the interaction between the two suggests that both are essential for optimizing performance and minimizing injury risk.

Dynamic balance is the ability to maintain stability while in motion, particularly during quick directional changes and sudden turns when executing soccer skills (Bloomfield et al., 2007). Effective balance enables athletes to perform technical skills proficiently while adapting to the dynamic and unpredictable nature of gameplay (Kostopoulos et al., 2012). For example, successful dribbling necessitates the ability to maneuver swiftly and change direction while maintaining balance, which is essential for ball control and minimizing the risk of dispossession by opponents. Additionally, dynamic balance plays a crucial role in shooting and passing, as players must efficiently shift their weight and adjust body positioning to generate accurate and powerful shots and passes (Wrisberg, 2007). Beyond offensive actions, dynamic balance is equally important in defensive performance, where defenders must constantly modify their stance to intercept passes, mark opponents, and regain possession of the ball (Da Costa et al., 2009). Furthermore, dynamic balance also influences key physical attributes such as acceleration, maximum speed, agility, and technical execution, all of which are essential for optimal soccer performance (Kim & Kang, 2022). Collectively, these factors contribute significantly to overall success in soccer.

Balance, either static or dynamic, has been extensively documented to improve through balance training across diverse populations, including athletes, older adults, or individuals undergoing rehabilitation (Behm et al., 2015). For instance, research has demonstrated that exercises such as single-leg standing, wobble board drills, and proprioceptive neuromuscular facilitation contribute to enhanced static balance, significantly improving postural control and reducing postural sway (Zech et al., 2010). Furthermore, Granacher et al. (2010) reported that athletes who incorporated these exercises exhibited superior postural stability during movement tasks compared to those who did not. Additionally, exercises such as agility drills, single-leg hops, and unstable surface training have been shown to enhance dynamic postural control (Lesinski et al., 2015). Paillard (2017) suggested that dynamic balance exercises offer greater functional benefits for athletes, as they closely replicate sports-related movements. Moreover, dynamic balance training has been found to enhance neuromuscular coordination, thereby contributing to improved athletic performance (Zahra et al., 2021). Consequently, the development of static and dynamic balance should be tailored to align with the specific demands of the athlete and their respective sport.

Despite the growing body of literature addressing various performance in soccer and balance, there remains a significant gap in research addressing the critical role of dynamic balance in soccer performance. Understanding the connection between dynamic balance and passing performance may provide valuable insights for coaches, trainers, and sports scientists in designing targeted training programs. If dynamic balance is found to significantly influence passing ability, balance training could be incorporated into soccer drills to enhance technical execution and overall gameplay. Therefore, the aim of this study is to investigate the relationship between dynamic balance and soccer passing ability in soccer players, exploring whether players with superior dynamic balance exhibit greater passing accuracy and efficiency. The second objective was to investigate playing abilities in different playing position. It was hypothesis that there is a significant relationship between dynamic balance and soccer skills performance and midfields will have better balance and soccer performances compared to other positions.

Methodology

Participants

Thirty-four soccer players (N= 34) volunteered to participate in this study (age 19.9 ± 1.23 years; Height: 1.73 ± 5.1 m, body mass: 67.6 ± 67 kg). All participants given their consent after being thoroughly informed the benefits and potential risks of the study. The participants were also asked to fill the Health Screening Questionnaire to ensure that they are healthy and free from any injury. The study protocol was approved by the University Research Ethics Committee (JKEP 13).

Experimental Design

Data were collected during the competitive season of Institut

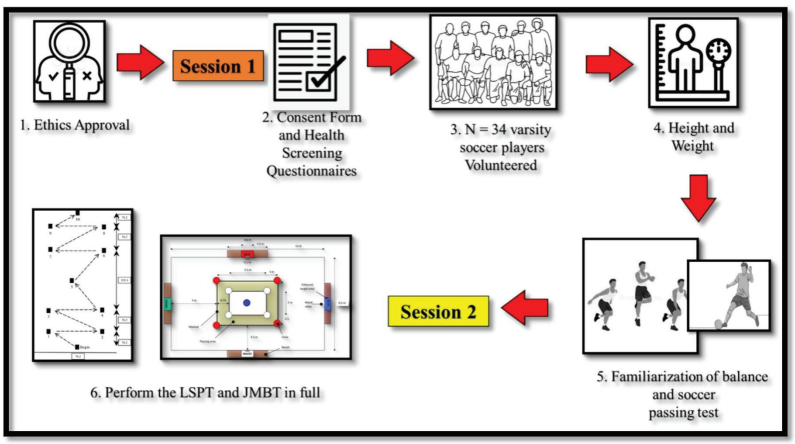

FIGURE 1. Data Collection Procedure

Pengajian Tinggi (IPT) Football League and took place in participants training ground. The participants were categorised into three playing position: Defender (N=11), Midfields (N=11) and Forward (N=12). The participants attended two sessions, one to familiarise them with the protocols and record the height and weight of the participants. Then they performed Johnson Modification of the Bass Test of Dynamic Balance (JMBT) and Loughborough Soccer Passing Test (LSPT). A JMBT was selected tool to assess dynamic balance and LSPT were used to assess the soccer skill performances. Following familiarisation, the JMBT and LSPT was performed in full in the second session. Participants completed three repetitions for each test (Trial 1, Trial 2 and Trial 3). Before each testing, participants performed a standardised 10 min warm up.

Johnson Modification of the Bass Test of Dynamic Balance (JMBT)

The JMBT test is a test that measures the ability to maintain balance during movement upon landing from a jump (Miller, 2005). The test required participants to maintain their base of support with one leg, reaching ten directions alternately with the other leg without compromising their base of support of the stance leg and hold for 5 seconds on each station. The test consists of 100 points with a maximum of 10 points that were given for each mark. The reliability level of JMBT was reported r =0.75 and face validity of 0.46.

The test scoring was given based on these criteria:

- 5 points will be given for landing successfully on the tape mark.
- 1 point is given for each second the steady position is held on tape marks; A maximum 10 points per tape mark and 100 points for the test may be earned; Any landing errors were penalized by 5 points.
- The landing error could be defined as failing to stop upon landing, touching the floor with any parts of the body other than the ball of the landing foot and failing to completely cover the tape mark with the ball of the foot.
- If the test performer makes a landing error, it could still have assumed correct balance if the performer could hold for maximum five seconds.
- If the performers landed accordingly but committed any errors before completing five seconds, 1 point will be deducted.
- The errors included touching the floor with any part of the body rather than the ball of the landing foot and failing to hold it for five seconds.
- If the performer lost balance, the test performer would return to the proper mark and jump to the next mark.

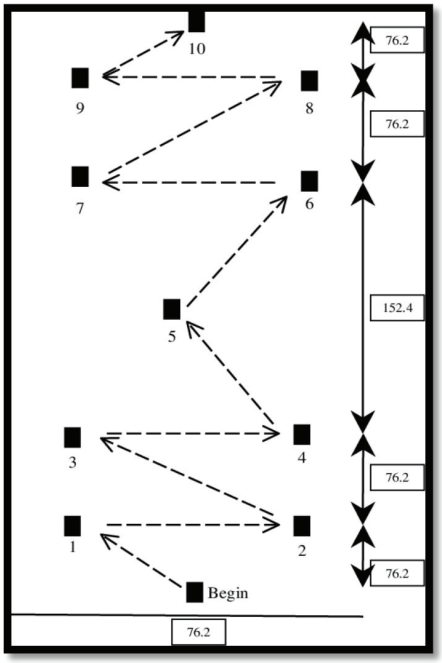

FIGURE 2. Schematic representation of the JMBT

Loughborough Soccer Passing Test (LSPT)

The LSPT was developed to assess the multi-faceted aspects of soccer skills including passing, dribbling, control and decision-making (Ali, Williams, Hulse, et al., 2007) and has been found to be a valid and reliable soccer skill performance for adolescents (Le Moal et al., 2013). The LSPT required players to complete 16 passes as quickly as possible. Le Moal et al. (2013) reported that LSPT test is a valid and reliable test to assess soccer skill performances. The reliability of the test was 0.83, and the validity was 0.64. Participants were informed that passes were only allowed to be executed from within the passing area, between the set of marked lines (see Figure 2). Participants were also told that upon retrieval from the previous pass, the ball had to cross two of the inner marked lines before the next pass could be attempted. Players must perform 16 passes against coloured target areas as quickly as possible (8 long (green and blue) and 8 short (white and red) (see Figure 2).

Penalty given if the participants performed the 16 passes more than 45 second. Penalty time was awarded for the following errors:

- 5 s for missing the bench completely or passing to the wrong bench.
- 3 s for missing the target area (0.6 x 0.3 m)
- 3 s for handling the ball
- 2 s for passing the ball from outside of the designated area.
- 2 s if the ball touched any cone
- 1 s for every second taken over the allocated 43 s to complete the test.
- 1 s was deducted from the total time if the ball hit the 10-cm strip in the middle of the target.

The penalty time was added to the time taken to complete the test and summed up as the total performance time.

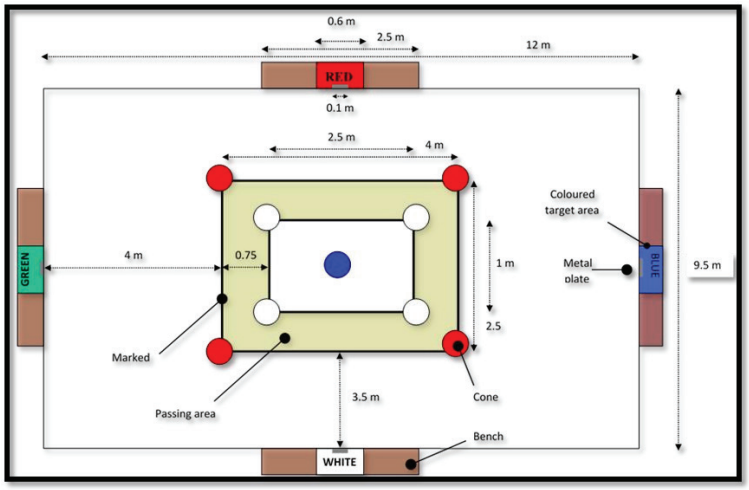

FIGURE 3. Schematic representation of the LSPT

Statistical Analysis

All results are reported as means ± standard deviations. Relationship between dynamic balance and soccer skills was assessed using the Pearson's product movement correlation (r) and Intra-class correlation coefficients (ICC). A one-way analysis of variance (ANOVA) was used to investigate differences between playing position and Repeated Measures ANOVA was conducted to compare performance across the three trials. All statistical analyses were performed with SPSS software (version 21.0, SPSS Inc, Chicago, IL) with the level of significance set at P≤ 0.05.

Results

Johnson Modification of the Bass Test of Dynamic Balance (JMBT)

Table 1 represents the mean ± SD of the JMBT scores. This data represents the performance of 34 participants across three trials, categorized by playing positions: Defenders, Midfielders, and Forwards. Overall Performance showed there is slight variation across trials, with Trial 3 showing the highest average score (92.4 ± 8.0) and lowest in standard deviation suggesting more consistent performance in that trial compared to Trials 1 and 2.

Table 1. Mean ± SD for Johnson Modification of the Bass Test of Dynamic Balance (JMBT)

Participants (n=34)	Trial 1	Trial 2	Trial 3	Mean ± SD
JMBT	87.2 ± 12.1	86.5 ±11.8	92.4 ±8.0	88.7 ± 9.2
Defender	86.8 ± 11.0	86.8 ±11.0	92.6 ±8.6	88..8 ± 8.4
Midfielder	88.9 ± 13.4	86.3 ±13.8	93.8 ±7.0	89.7 ± 10.3
Forward	85.8 ± 15.3	85.8 ±13.2	89.5 ±8.1	87.1± 11.2

Performance by position showed Defender performance is stable in Trials 1 and 2 (86.8) but improves in Trial 3. Midfielder showed a slight dip in Trial 2 but perform best in Trial 3 and Forward have the lowest mean performance and the least improvement in Trial 3 indicating less consistency compared to other positions. The improvement in Trial 3 across all groups suggests that familiarity with the task or test may have played a role in better performance. A repeated measures ANOVA was conducted to compare performance across the three trials. The results indicated a significant effect of trial on performance (P< 0.05). This suggests that participants' performance significantly changed over time, indicating players improved or changed their performance over time. One-way ANOVA was conducted to compare the performance differences among positions (Defenders, Midfielders, and Forwards). The results indicated that there was no statistically significant effect of positional role on performance (P>0.05). These findings suggest that playing position did not strongly influence performance in this test. Players significantly improved over the three trials (likely due to learning effects or warm-up). No significant difference between positions, suggesting that all positions performed similarly.

Loughborough Soccer Passing Test (LSPT)

Table 2 represents the mean ± SD of performance time (including penalty time) for the LSPT across three trials among 34 participants, categorized by playing position (Defender, Midfielder, and Forward). The mean performance time decreased from Trial 1 to Trial 3, indicating an improvement in passing efficiency. The overall group mean time was 104.6s in Trial 1, 95.7s in Trial 2, and 88.8s in Trial 3, with a final average of 96.4s ± 5.9. This suggests that participants improved their passing ability over successive trials, potentially due to better decision-making, ball control, or adaptation to test conditions.

Table 2. Mean ± SD for Loughborough Soccer Passing Test (LSPT)

Participants (n=34)	Trial 1	Trial 2	Trial 3	Mean ± SD
	Performance Time including penalty time			
LSPT	104.6 ± 12.8	95.7 ±10.4	88.8 ±11.6	96.4 ± 5.9
Defender	107.4 ± 11.2	96.2 ±9.8	92.6 ±7.2	98.7 ± 5.8
Midfielder	103.2 ± 8.2	93.8 ±6.4	85.7 ±18.4	94.2 ± 6.0
Forward	97.8 ± 20.9	96.8 ±17.1	81.3 ±5.0	92.0± 6.2

Defender had the highest overall mean time (98.7s ± 5.8), indicating they were the slowest among the three positions. Their improvement from 107.4s (Trial 1) to 92.6s (Trial 3) was notable but still slower than other positions. Midfielder performed slightly better than defenders, with an overall mean of 94.2s ± 6.0, and showed consistent improvement across trials, dropping from 103.2s (Trial 1) to 85.7s (Trial 3). In contrast, Forward recorded the fastest times overall (92.0s ± 6.2), with a significant improvement from 97.8s (Trial 1) to 81.3s (Trial 3). Their lower times align with the expectation that forwards need quick, precise passing under pressure. The One-Way ANOVA results show a significant difference between positions on LSPT performance (P< 0.05). Forward having the best performance compared to Defender and Midfielder. No differences were observed between Defender and Midfielder. This suggests that Forwards may have superior passing efficiency compared to Defenders, possibly due to their offensive role requiring quick ball movement. Midfielders, who balance both attacking and defensive duties, showed intermediate performance.

Relationship between Dynamic Balance and Soccer Skill Performances

The Pearson correlation coefficient (r=0.77) indicates a strong positive relationship between dynamic balance and soccer skill performance, as shown in Figure 1. The trend in the graph suggests that players with higher dynamic balance scores are more likely to demonstrate better soccer skill performance.

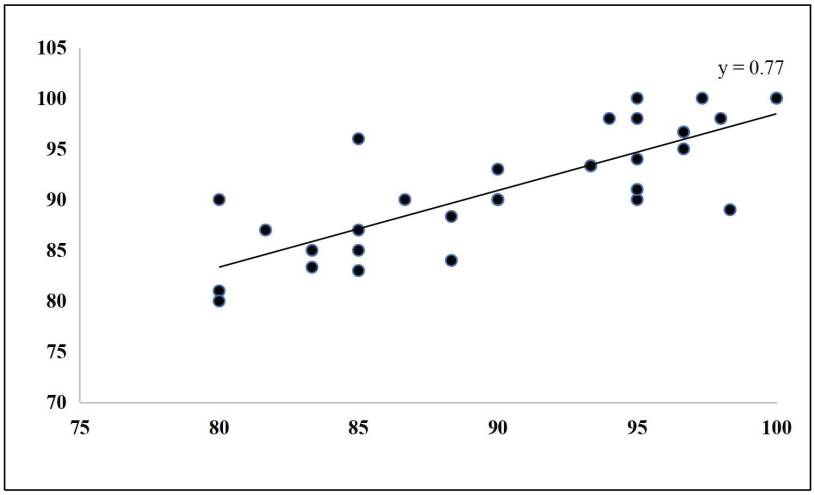

FIGURE 4. The relationship between JMBT and LSPT

Discussion

The aims of this study were to investigate the relationship between dynamic balance and soccer passing ability in soccer players and the objective was to investigate playing abilities in different playing positions. The results indicate a significant positive correlation between dynamic balance and passing performance, suggesting that players with better dynamic balance tend to execute more accurate and effective passes. This supports the notion that balance is a fundamental component of technical skill execution in soccer. This aligns with previous study by Atan (2009), that have highlighted improvement on dynamic balance significantly improved passing ability in soccer players. One possible explanation for this relationship is that maintaining stability during dynamic movements allows players to exert better control over their lower limbs, leading to more precise passing. Since passing often occurs under pressure and in motion, a player's ability to maintain balance can directly impact their success in executing accurate passes.

Nevertheless, it is important to highlight that the soccer passing skill observed in this player cohort was poor when compared to previous studies. Impellizzeri et al. (2008) reported faster time in comparison to junior soccer players (mean age: 17.8 ± 0.6 years; Height: 1.78 ± 0.5 m; Weight: 74.5 ± 6.9 kg), with an average completion time of 60.7 ± 4.1 seconds, including penalty time. Similarly,

Rampinini et al. (2008) recorded a completion time of 65.5 ± 8.9 s for the LSPT. Meanwhile, Ali et al. (2007) demonstrated improved soccer skill performance influenced by carbohydrate intake, with a total completion time of 50.5 ± 5.5 seconds in semi-professional and university team players (mean age: 21.3 ± 3.0 years; Height: 1.80 ± 0.07 m; Weight: 74.6 ± 6.8 kg; VO2max: 56.0 ± 1.6 mL.kg.min1). In contrast, in the current study, participants required 96.4 ± 5.9 seconds to complete the 16-passes of the LSPT. Passing is a fundamental skill that requires a combination of proper technique, body positioning, weight transfer, and accuracy to maintain ball possession, creating goal-scoring opportunities, and determining the pace of the game (Torrey et al., 2005). Furthermore, the LSPT involves quick decision-making. The test requires players to make rapid decisions under time constraints, as they must pass the ball accurately to designated targets while adjusting their actions based on the test's structured sequence. If individuals are unable to perform the LSPT quickly, it may indicate deficiencies in cognitive processing speed, reaction time, or technical ability, all of which are crucial for high-level soccer performance (Romeas, Guldner & Faubert, 2016). Slow execution in this current study result in increased completion times and errors, highlighting areas for improvement in player training programs. This can be improved by practice regularly in passing technique, both individually and in game-like scenarios which focus on accuracy, weight of the pass, and decision-making. Furthermore, soccer players can seek feedback from coaches, teammates, or experienced players. They can provide insights into areas for improvement and offer guidance on refining players passing technique (Carling et., 2005).

Additionally, this study also investigated playing abilities in different playing positions. No differences were found between positions in dynamic balance, however significant differences were found in passing ability. Forwards indicated the best performance compared to defenders and midfielders which can be attributed from the positional roles, consequently, result in higher passing accuracy and efficiency due to their frequent involvement in attacking during match plays (Lago Peñas et al., 2012).

Despite these results, some limitations should be addressed in this current study. The study was conducted on university-level players, and the findings may not be generalizable to younger or elite professional players. Additionally, external factors such as fatigue, environmental conditions, and psychological pressure were not controlled, which could influence passing performance. Future research should explore the impact of specific balance training programs on passing accuracy and overall soccer performance. Longitudinal studies could provide more conclusive evidence on how balance improvements translate into game performance. Furthermore, investigating the role of other physical attributes, such as agility and reaction time, in relation to passing ability would offer a more comprehensive understanding of soccer performance determinants.

Additionally, the sample size in this present study was limited to university-level soccer players only, which may limit the generalizability of the findings to players from other competitive levels or age groups. Moreover, the assessment of dynamic balance and passing ability was conducted under controlled conditions, which may not fully reflect the complex and unpredictable nature of actual match situations. Additionally, variations in participants' training background, fatigue levels, and motivation during testing could have influenced the results. Lastly, only selected aspects of balance and passing were examined; other factors such as decision-making, vision, and technical execution under pressure were not considered but may also contribute to passing performance.

Conclusion

In conclusion, the study highlights the importance of dynamic balance in soccer passing ability and underscores the need for incorporating balance-related exercises into training programs. By improving balance, players may enhance their technical execution, ultimately contributing to better overall performance on the field. The findings of this study may have practical implications for soccer training and performance, as improving dynamic balance may contribute to better soccer passing ability.

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