ISSN: 2348-1838 Vol. 5; Issue 5, May 2026

INTERNATIONAL JOURNAL OF
PHYSICAL THERAPY RESEARCH & PRACTICE
AN OFFICIAL JOURNAL OF SAUDI PHYSICAL THERAPY ASSOCIATION

S P T A
الجمعية السعودية للعلاج الطبيعي
Saudi Physical Therapy Association

Review Article

Postural Stability as a Predictor of Explosive Lower Limb Performance in Young Adults: A Gender-Based Analysis

Ahmed Ghazwani[1*]; Junaid A Kirmani[1]; Saravanakumar K Nanjan[1]; Bharath K Mallela[1]; Bhuvanesh M Ganesan[1]; Rashid A Beg[1]

1. College of Nursing and Health Sciences, Department of Physical Therapy, Jazan University, Jazan, Saudi Arabia.

*Corresponding Author: Aghazwani1@jazanu.edu.sa

Abstract

Background: Postural stability contributes to neuromuscular control and may influence explosive lower limb performance. Objective: To investigate the association and predictive relationship between balance performance and standing forward jump distance in young adults. **Methods:** Eighty healthy university students (40 males, 40 females; aged 20–23 years) participated. Balance was assessed using the Single-Leg Stance (SLS) test (seconds), and explosive lower limb performance was measured using the standing forward jump test (cm). Pearson correlation and linear regression analyses were performed. **Results:** A strong positive correlation was observed in the total sample ($r = 0.786$, $p < 0.001$). Strong correlations were found in males ($r = 0.784$, $p < 0.001$) and females ($r = 0.709$, $p < 0.001$). Linear regression showed that balance significantly predicted jump performance ($R^2 = 0.618$, $p < 0.001$). **Conclusion:** Postural stability is strongly associated with and predictive of explosive lower limb performance.

Keywords: Postural stability, balance, forward jump, explosive performance, neuromuscular control..

Received : **May. 09, 2026** Accepted: **May. 12, 2026** Published : **May. 31, 2026**

To Cite: *Ahmed Ghazwa*; Junaid A Kirmani; Saravanakumar K Nanjan; Bharath K Mallela; Bhuvanesh M Ganesan; Rashid A Beg. Postural Stability as a Predictor of Explosive Lower Limb Performance in Young Adults: A Gender-Based Analysis. (2026). International Journal of Physical Therapy Research & Practice, 5(5), 280-285. https://doi.org/10.62464/0s8dnm69.*

INKWELL INFINITE PUBLICATION LLC.

Introduction

Explosive lower limb performance is fundamental for athletic participation and functional mobility. Jump performance requires coordinated neuromuscular activation, joint stability, and effective kinetic chain function. Postural stability facilitates optimal alignment and may reduce energy dissipation during force production. Efficient transfer of force from proximal to distal segments is essential for maximizing horizontal propulsion, and any disruption in trunk or lower limb control may compromise performance output (Kibler et al., 2006).

Balance integrates proprioceptive, vestibular, and visual systems to maintain equilibrium. Adequate postural control enhances sensorimotor integration and allows the central nervous system to regulate muscle activation patterns efficiently during dynamic tasks (Paillard, 2012). In horizontal jumping activities, anticipatory postural adjustments and coordinated lower limb activation play a critical role in optimizing propulsion and landing mechanics. From a biomechanical perspective, balance contributes to maintaining proper joint alignment at the ankle, knee, and hip during force generation, thereby enhancing mechanical efficiency (Hrysomallis, 2011).

Impaired balance has been associated with decreased athletic performance and increased injury risk. Neuromuscular deficits may alter joint kinematics, reduce force transmission efficiency, and compromise movement quality (Zech et al., 2010). Moreover, balance training interventions have been shown to improve performance measures and reduce lower extremity injury incidence, highlighting the functional and clinical relevance of postural control (Granacher et al., 2013).

Although prior research has extensively examined muscular strength, plyometric training, and core stability in relation to performance outcomes, fewer studies have directly quantified the relationship between static balance ability and horizontal jump performance using simple field-based assessments. Most investigations have focused on vertical jump performance or laboratory-based evaluations rather than functional horizontal propulsion tasks (Hibbs et al., 2008). Additionally, gender-based comparisons examining the association between balance and explosive performance remain limited, despite documented physiological and neuromuscular differences between males and females.

Therefore, examining the association between single-leg stance performance and forward jump distance may provide valuable insight into the contribution of postural stability to explosive movement capacity. A clearer understanding of this relationship may inform physical therapy interventions aimed at enhancing neuromuscular control, optimizing performance, and reducing injury risk in young adults.

Methods

Participants

A total of 80 healthy young adult university students (40 males and 40 females) participated in this cross-sectional study.

Ethical Considerations

This study was approved by the Committee for Research Ethics, Jazan University (Reference No: REC-46/09/1403; dated 04-03-2025). Written informed consent was obtained from all participants.

Procedures

- Postural stability was assessed using the Single-Leg Stance (SLS) test, a widely used clinical measure of static balance performance. Participants were instructed to stand barefoot on their dominant leg with the contralateral knee flexed to approximately 90 degrees. The hands were placed on the hips to minimize upper limb compensation. Participants were asked to maintain an upright posture while focusing on a fixed point at eye level to standardize visual input. Timing began once the non-supporting foot left the ground and stopped when the raised foot touched the floor, the stance foot shifted position, or the hands left the hips. Balance time was recorded in

seconds using a digital stopwatch. Each participant performed two trials, and the best performance was used for analysis to minimize variability and account for learning effects.

- Explosive lower limb performance was evaluated using the standing forward jump test, which measures horizontal propulsion capacity. Participants stood behind a marked starting line with feet shoulder-width apart. They were instructed to perform a countermovement by flexing the hips and knees before explosively jumping forward as far as possible using both legs simultaneously. Arm swing was permitted to allow natural movement and maximize jump distance. The landing position was required to be stable, with both feet contacting the ground simultaneously without falling backward. The distance from the starting line to the posterior aspect of the heel closest to the start line was measured in centimeters using a measuring tape fixed to the floor. Two trials were performed, with the longest distance recorded for statistical analysis.
- Both assessments were conducted on a firm, level, non-slip surface in a controlled indoor environment to ensure safety and standardization. Participants were provided with standardized verbal instructions and demonstration prior to testing. A brief warm-up consisting of light dynamic lower limb movements was completed before data collection to reduce injury risk and improve test reliability.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (mean ± standard deviation) were calculated for all demographic and performance variables. The normality of data distribution was assessed using the ShapiroWilk test and visual inspection of histograms to confirm the appropriateness of parametric testing.

Pearson's product moment correlation coefficient (r) was used to examine the strength and direction of the linear association between balance performance (Single-Leg Stance time) and explosive lower limb performance (forward jump distance). Correlation coefficients were interpreted as follows: 0.00–0.19 (very weak), 0.20–0.39 (weak), 0.40–0.59 (moderate), 0.60–0.79 (strong), and 0.80–1.00 (very strong).

To evaluate predictive capacity, a simple linear regression analysis was conducted with forward jump distance as the dependent variable and balance time as the independent variable. The standardized regression coefficient (β), coefficient of determination (R^2), and associated p-values were reported to determine the proportion of variance in jump performance explained by balance performance. Subgroup analyses were performed for male and female participants to explore potential gender-based differences in the strength of association. Statistical significance was set at $p < 0.05$ for all analyses.

Results

Table 1. Demographic and Performance Characteristics (Mean ± SD)

Gender	Female (n=40)	Male (n=40)
Age (Yrs)	21.28 ± 1.06	21.63 ± 1.19
Height (cm)	155.71 ± 3	169.23 ± 2.8
Weight (kg)	56.79 ± 6.84	71.15 ± 7.83
Balance (sec)	19.36 ± 2.46	22.84 ± 3.14
Forward Jump (cm)	112.03 ± 7.6	140.70 ± 9.9

Pearson's product moment correlation analysis demonstrated a statistically significant strong positive association between balance performance and forward jump distance in the total sample ($r(78) = 0.786$, $p < .001$). Participants with longer single-leg stance times tended to achieve greater horizontal jump distances. When stratified by gender, strong positive correlations were observed in both male and female subgroups. In males, balance performance was strongly associated with forward jump distance ($r(38) = 0.784$, $p < .001$). Similarly, females demonstrated a strong positive relationship between variables ($r(38) = 0.709$, $p < .001$). These findings indicate that the association between postural stability and explosive lower limb performance is consistent across genders.

Simple linear regression analysis further revealed that balance performance significantly predicted forward jump distance, $F(1, 78) = 125.86$, $p < .001$. The model explained 61.8% of the variance in jump performance ($R^2 = 0.618$). The unstandardized regression coefficient indicated that for every one-second increase in balance time, forward jump distance increased by approximately 4.01 cm (B = 4.01, 95% CI [3.30, 4.72]). This suggests a substantial predictive relationship between postural stability and explosive lower limb performance.

Figures

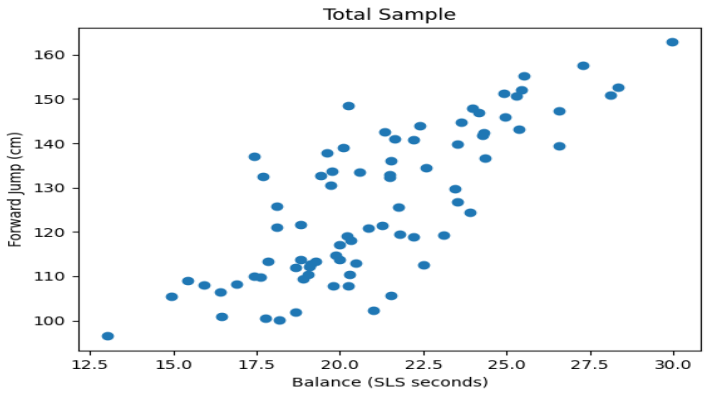

Figure 1: Scatter plot illustrating the relationship between balance performance (Single-Leg Stance time) and forward jump distance in the total sample (n = 80). The solid line represents the unstandardized linear regression model.

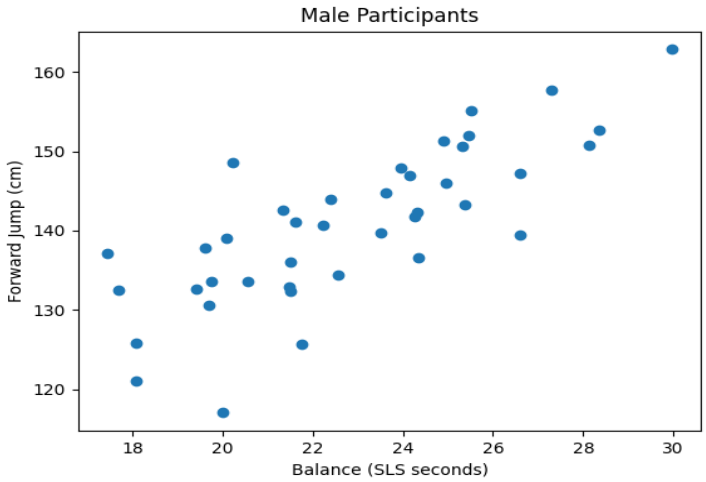

Figure 2: Scatter plot illustrating the relationship between balance performance (SLS time) and forward jump distance in male participants.

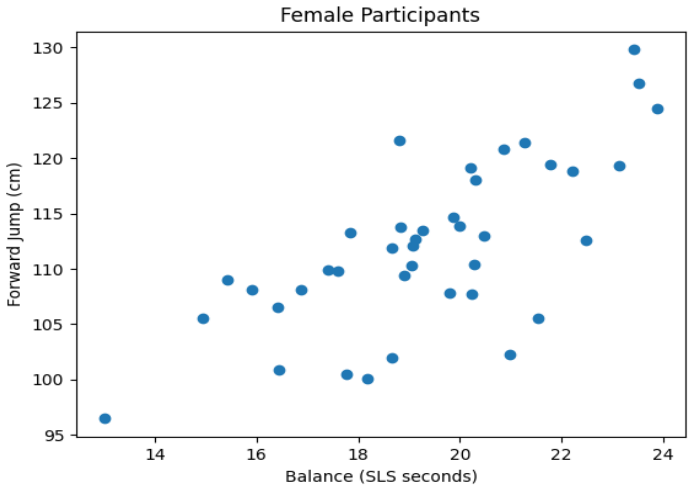

Figure 3: Scatter plot illustrating the relationship between balance performance (SLS time) and forward jump distance in female participants.

Discussion

The present findings demonstrate that postural stability is strongly associated with explosive lower limb performance in young adults. Both correlational and regression analyses revealed a substantial relationship between balance capacity and forward jump distance, with balance explaining 61.8% of the variance in jump performance. These results indicate meaningful predictive capacity, suggesting that improved balance may enhance force production efficiency and optimize kinetic chain function during horizontal propulsion tasks.

From a neuromechanical perspective, postural stability facilitates proximal control, allowing efficient distal force transmission during explosive movements (Kibler et al., 2006). Adequate sensorimotor integration enhances anticipatory postural adjustments and muscle activation timing, which are critical for maximizing jump performance (Paillard, 2012). Balance ability has previously been identified as a determinant of athletic performance, particularly in tasks requiring coordination and dynamic stability (Hrysomallis, 2011, Aafreen 2025).

The predictive relationship observed in the present study aligns with evidence demonstrating that neuromuscular training and balance interventions can improve performance outcomes (Granacher et

al., 2013; Zech et al., 2010). Improvements in proprioceptive feedback and motor unit synchronization may reduce energy dissipation and enhance propulsion efficiency during the push-off phase of jumping (Gruber & Gollhofer, 2004). Furthermore, neuromuscular control has been shown to contribute to improved movement economy and reduced injury risk, reinforcing the clinical relevance of balance capacity (Emery et al., 2005, Sharan, S et al,2024).

Previous research has largely focused on vertical jump performance or core stability measures (Hibbs et al., 2008; Nesser et al., 2008), whereas fewer investigations have quantified the predictive association between static balance and horizontal jump performance using simple field-based assessments. The present study extends existing literature by demonstrating that static balance, measured via the Single-Leg Stance test, is not merely correlated with but significantly predicts explosive lower limb performance.

Clinically, these findings support the integration of balance-focused interventions within physical therapy and athletic conditioning programs. Given that neuromuscular deficits are linked to both performance limitations and injury susceptibility, incorporating balance assessment and training may serve dual purposes—performance enhancement and injury prevention (McGuine & Keene, 2006).

Clinical Implications

The findings of this study have meaningful implications for physical therapy and athletic conditioning practice. The strong association and predictive capacity observed between balance performance and explosive lower limb ability suggest that static balance assessment, such as the Single-Leg Stance (SLS) test, may serve as a practical, time-efficient, and cost-effective screening tool for identifying deficits in neuromuscular control. Given that balance performance explained a substantial proportion of variance in forward jump distance, clinicians may consider incorporating targeted neuromuscular and balance training interventions to enhance force production efficiency and optimize kinetic chain function. Improving postural stability may contribute not only to enhanced explosive performance but also to improved joint alignment, movement coordination, and reduced injury susceptibility. Therefore, integrating balance-focused exercises into rehabilitation and conditioning programs may provide dual benefits by simultaneously supporting performance enhancement and musculoskeletal injury prevention.

Limitations

The cross-sectional design of the present study limits the ability to establish causal relationships between postural stability and explosive lower limb performance. Although a strong association and significant predictive relationship were identified, it cannot be concluded that improvements in balance directly result in enhanced jump performance. Longitudinal and interventional studies are therefore warranted to determine whether targeted balance training leads to measurable improvements in explosive performance outcomes and to further clarify the directionality of this relationship..

Conclusion

Postural stability is strongly and significantly associated with explosive lower limb performance in young adults and demonstrates meaningful predictive capacity. The findings indicate that balance performance contributes substantially to horizontal propulsion ability, with regression analysis showing that each one second increase in balance time corresponds to an approximate 4 cm increase in forward jump distance. This highlights the important role of neuromuscular control in optimizing force production efficiency and mechanical performance during explosive tasks. These results support the integration of balance assessment and targeted neuromuscular training within physical therapy and athletic conditioning programs to enhance performance and potentially reduce injury risk. Further longitudinal research is warranted to determine whether improvements in balance directly translate into measurable gains in explosive performance.

Reference

Aafreen, A., Khan, A.R., Khan, A., Ahmad, A., Aldhahi, M.I., Alsalem, W.O., Alshehri, M.M., Moafa, A.B., Ghazwani, A. and Shaphe, M.A., (2025). Comparative analysis of upper body postural angles and their association with neck pain in car and motorcycle drivers. Transportation Research Interdisciplinary Perspectives, 32, p.101534. https://doi.org/10.1016/j.trip.2025.101534

Behm, D. G., & Anderson, K. (2006). The role of instability with resistance training. Journal of Strength and Conditioning Research, 20(3), 716–722. DOI: 10.1519/R-18475.1

Emery, C. A., Cassidy, J. D., Klassen, T. P., Rosychuk, R. J., & Rowe, B. H. (2005). Effectiveness of a home-based balance-training program in reducing sports-related injuries among healthy adolescents: a cluster randomized controlled trial. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne, 172(6), 749–754. https://doi.org/10.1503/cmaj.1040805

Schedler, S., Brock, K., Fleischhauer, F., Kiss, R., & Muehlbauer, T. (2020). Effects of Balance Training on Balance Performance in Youth: Are There Age Differences?. Research quarterly for exercise and sport, 91(3), 405–414. https://doi.org/10.1080/02701367.2019.1676371

Gruber, M., & Gollhofer, A. (2004). Impact of sensorimotor training on the rate of force development and neural activation. European journal of applied physiology, 92(1-2), 98–105. https://doi.org/10.1007/s00421-004-1080-y

Hibbs, A. E., Thompson, K. G., French, D., Hodgson, D., & Spears, I. (2008). Optimizing performance by improving core stability and core strength. Sports Medicine, 38(12), 995–1008. DOI: 10.2165/00007256-200838120-00004

Hrysomallis, C. (2011). Balance ability and athletic performance. Sports Medicine, 41(3), 221–232. DOI: 10.2165/11538560-000000000-00000

Kibler, W. B., Press, J., & Sciascia, A. (2006). The role of core stability in athletic function. Sports Medicine, 36(3), 189–198. DOI: 10.2165/00007256-200636030-00001

Lephart, S. M., Pincivero, D. M., Giraldo, J. L., & Fu, F. H. (1997). The role of proprioception in the management and rehabilitation of athletic injuries. Journal of Athletic Training, 32(3), 188–196. DOI: 10.1177/036354659702500126

McGuine, T. A., & Keene, J. S. (2006). The effect of a balance training program on the risk of ankle sprains in high school athletes. American Journal of Sports Medicine, 34(7), 1103–1111. DOI: 10.1177/0363546505284191

Nesser, T. W., Huxel, K. C., Tincher, J. L., & Okada, T. (2008). The relationship between core stability and performance in Division I football players. Journal of Strength and Conditioning Research, 22(6), 1750–1754. DOI: 10.1519/JSC.0b013e3181874564

Paillard, T. (2012). Effects of general and local fatigue on postural control: A review. Journal of Strength and Conditioning Research, 26(2), 535–542. DOI: 10.1016/j.neubiorev.2011.05.009

Prieske, O., Muehlbauer, T., Borde, R., Gube, M., Bruhn, S., & Granacher, U. (2016). Neuromuscular and athletic performance following core strength training in youth athletes. Scandinavian Journal of Medicine & Science in Sports, 26(1), 48–56. DOI: 10.1111/sms.12403

Stanton, R., Reaburn, P. R., & Humphries, B. (2004). The effect of short-term Swiss ball training on core stability and running economy. Journal of Strength and Conditioning Research, 18(3), 522–528. DOI: 10.1519/1533-4287(2004)18<522:TEOSSB>2.0.CO;2

Sharan, S., Sheereen, F. J., Chahal, A., Alshehri, M. M., Najmi, A. A. A., Alajam, R. A., & Shaphe, M. A. (2024). Comparison of fatigue level, musculoskeletal disorders and physical activity level in aircraft engineers working in the morning shift and night shift. Physikalische Medizin, Rehabilitationsmedizin, Kurortmedizin, 34(02), 79-84. DOI: 10.1055/a-2015-3538

Taube, W., Gruber, M., & Gollhofer, A. (2008). Spinal and supraspinal adaptations associated with balance training and their functional relevance. Journal of Applied Physiology, 105(4), 1290–1299. DOI: 10.1111/j.1748-1716.2008.01850.x

Zech, A., Hübscher, M., Vogt, L., Banzer, W., Hänsel, F., & Pfeifer, K. (2010). Balance training for neuromuscular control and performance enhancement: A systematic review. Sports Medicine, 40(6), 427–448. DOI: 10.4085/1062-6050-45.4.392