JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

https://doi.org/10.61919/3r1rwb16

Original Article

Association of Single Leg Bridge Test Scores and Hamstring Weakness with Pain, and Functional Performance in Amateur Players

Irum Shahzad[1], Marian Gabriel[1], Ahmad Faraz[2], Qurat ul Ain[3], Muhammad Hashim[4], Aqsa Majeed[5]

[1] Riphah International University, Gulberg III, Lahore, Pakistan
[2] Physiogic Physiotherapy Clinic, Lahore, Pakistan
[3] Senior Lecturer, Faculty of Rehabilitation and Allied Health Sciences, Riphah International University, Gulberg III, Lahore, Pakistan
[4] Assistant Professor, Faculty of Rehabilitation and Allied Health Sciences, Riphah International University, Lahore, Pakistan
[5] Lecturer, University Institute of Physical Therapy, Faculty of Allied Health Sciences, The University of Lahore, Lahore, Pakistan

***Corresponding author: Irum Shahzad, Email: irumshahzad36@gmail.com.**

"Cite this Article" **Received**: 07 December 2025; **Accepted**: 19 May 2026; **Published**: 03 June 2026
Author Contributions: Concept: IS, MG; Design: IS, MG; Data Collection: IS; Literature Review: MG, AM, MH; Data Analysis and Interpretation: MG, QA; Manuscript Drafting: MG; Final Review and Approval: IS, MG, QA, AM, MH. **Ethical Approval**: Riphah International University, Gulberg III, Lahore, Pakistan. **Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: N/A.

ABSTRACT

Background: Hamstring weakness may contribute to pain, altered lower-limb control, and reduced functional movement quality in young football players, yet field-based evidence linking hamstring performance with pain and movement screening outcomes remains limited. Objective: To examine the association of Single Leg Bridge Test performance with pain intensity and Functional Movement Screen scores among youth amateur football players. Methods: This cross-sectional analytical study included 82 youth amateur football players recruited from football clubs and a physiotherapy clinic between September and December 2024. Hamstring performance was assessed using the Single Leg Bridge Test, pain intensity using the Numeric Pain Rating Scale, and functional movement quality using the Functional Movement Screen. Because data were non-normally distributed, Spearman's rho correlation was used to examine associations among clinical variables. Results: The mean age of participants was 16.2 ± 1.8 years, and 56 players (68.3%) were male. Mild pain was reported by 41 participants (50.0%), while 31 players (37.8%) had poor SLBT performance and 46 (56.1%) had average performance. FMS findings showed that 34 participants (41.5%) had poor scores and 19 (23.2%) had below-average scores. SLBT performance was strongly and negatively associated with pain intensity ($\rho = -0.691$, $p < 0.001$) and positively associated with FMS cumulative score ($\rho = 0.303$, $p = 0.006$). Conclusion: Better SLBT performance was associated with lower pain intensity and better functional movement quality, supporting the clinical value of combined hamstring and movement screening in youth amateur football players. Keywords: hamstring weakness, Single Leg Bridge Test, Numeric Pain Rating Scale, Functional Movement Screen, football players, youth athletes

INTRODUCTION

Hamstring weakness is a clinically important modifiable factor in football because the hamstring muscle group contributes substantially to sprinting, deceleration, kicking, change of direction, pelvic control, and lower-limb force absorption during high-intensity play. In adolescent and youth athletes, inadequate hamstring strength may be particularly relevant because rapid growth, neuromuscular maturation, training-load variation, and sport-specific demands can alter lower-limb control and increase susceptibility to pain, movement compensation, and performance limitations. Hamstring strain injuries are consistently reported among the most frequent muscle injuries in football and other running-based sports, with substantial consequences for training availability, match participation, rehabilitation duration, and recurrence after return to play (1,2). Beyond acute injury occurrence, insufficient posterior-

ISSN 3007-0570 | © 2026 The Authors | CC BY 4.0

chain strength may also contribute to altered lower-limb mechanics, reduced sprint acceleration, impaired agility, and diminished functional movement quality, all of which are central to football performance in developing players (3,4).

The relationship between hamstring strength and functional athletic performance has been increasingly emphasized in sports rehabilitation research. Eccentric hamstring capacity, particularly when assessed through football-relevant strengthening tasks such as the Nordic hamstring exercise, has been associated with sprint performance and lower-limb power in youth football populations (5). Sprint-based and eccentric strengthening interventions have also been shown to improve hamstring strength and running performance in adolescent athletes, supporting the role of posterior-chain conditioning in both performance development and injury-prevention strategies (6). However, while laboratory-based and technology-assisted assessments can provide precise strength data, they may be difficult to implement routinely in amateur football settings where clinicians, coaches, and trainers often require simple, low-cost, field-based screening tools. The Single Leg Bridge Test offers a practical alternative for evaluating hamstring endurance, posterior-chain function, and lumbopelvic control, making it potentially useful for identifying players with suboptimal hamstring performance in community and academy environments (7).

Functional movement quality is another important dimension of athletic screening because football performance depends not only on isolated muscle strength but also on coordinated movement across the trunk, pelvis, hip, knee, and ankle. The Functional Movement Screen evaluates fundamental movement patterns such as squatting, stepping, lunging, trunk stability, rotary stability, and active straight-leg raising, which are relevant to lower-limb control and movement efficiency in sport. Lower FMS composite scores have been associated with movement deficits and may indicate the need for corrective exercise or further clinical assessment, although FMS should not be interpreted as a standalone diagnostic or predictive tool without consideration of sport context, previous injury, maturation, and training exposure (8,9). In young football players, combining hamstring-specific field assessment with functional movement screening may therefore provide a more clinically meaningful picture of performance-related limitations than either measure alone.

Despite the recognized importance of hamstring strength in football, much of the available literature has focused on hamstring injury epidemiology, eccentric strength deficits, inter-limb asymmetry, or hamstring-to-quadriceps ratios, while fewer studies have examined how field-based hamstring performance relates simultaneously to pain intensity and functional movement quality in youth amateur players. This gap is important because young athletes may continue training despite mild or intermittent posterior thigh or knee symptoms, and these symptoms may coexist with reduced strength endurance and compensatory movement patterns. Understanding these associations may help clinicians and coaches identify athletes who require targeted strengthening, movement correction, or training-load modification before impairments become more limiting. Therefore, this study aimed to examine the association of Single Leg Bridge Test performance with pain intensity and Functional Movement Screen scores among youth amateur football players. It was hypothesized that lower SLBT performance would be associated with higher pain intensity and poorer functional movement quality.

MATERIALS AND METHODS

This cross-sectional analytical study was conducted over a four-month period from September to December 2024 among youth amateur football players recruited from Physiogic Physiotherapy Clinic and associated football clubs, including Fame Football Club and Academy and Model Town Football Club. The study was designed to examine associations among hamstring performance, pain intensity, and functional movement quality using field-based clinical assessment tools. A cross-sectional design was selected because the objective was to determine the direction and strength of relationships among measured variables at a single point in time rather than to evaluate causality, treatment effect, or prospective injury risk.

A total of 82 amateur football players were included through non-probability convenience sampling. Participants were eligible if they were youth football players aged 12–19 years, male or female, actively participating in football training, and available for completion of the full assessment protocol. Players were required to have regular football participation during the preceding six months so that the sample represented athletes with ongoing exposure to football-specific lower-limb demands. Participants were excluded if they had neurological conditions affecting motor control, lower-limb surgery within the previous six months, acute lower-extremity injury within the previous six weeks, chronic systemic disease affecting physical performance, pregnancy, use of assistive walking devices, or current use of pain medication that could alter pain reporting or functional test performance. Eligibility criteria were applied before data collection to reduce clinical heterogeneity and avoid inclusion of athletes whose test scores could be substantially influenced by acute injury, neurological impairment, or medication-related symptom modification.

Data were collected using a standardized assessment sequence. Demographic and training-related information was recorded first, including age, gender, body mass index category, predominant training type, weekly training exposure, session duration, warm-up duration, and other relevant training characteristics. Pain intensity was then assessed using the Numeric Pain Rating Scale, an 11-point self-reported scale ranging from 0 to 10, where 0 indicates no pain and 10 indicates the worst imaginable pain. For descriptive interpretation, pain was categorized as no pain, mild pain, moderate pain, or severe pain according to the recorded NPRS score, while correlation analysis used the recorded pain score as the pain-intensity variable where available (10).

Hamstring performance was assessed using the Single Leg Bridge Test. During the test, the participant assumed a single-leg bridge position while the contralateral limb remained extended, and repetitions were counted according to standardized test performance criteria. SLBT performance was categorized as poor when the participant completed 20 or fewer repetitions, average when 21–30 repetitions were completed, and good when more than 30 repetitions were completed. The test was used as a field-based indicator of hamstring endurance, posterior-chain function, and lumbopelvic control rather than as a direct laboratory measure of maximal hamstring strength (7). To improve consistency, participants received standardized instructions before testing, and performance was recorded using the same scoring criteria across all participants.

Functional movement quality was assessed using the Functional Movement Screen, which includes seven movement components: deep squat, hurdle step, in-line lunge, shoulder mobility, active straight-leg raise, trunk stability push-up, and rotary stability. Each component was scored from 0 to 3 according to standard FMS scoring principles, and the total composite score was calculated out of 21. For descriptive reporting, FMS scores were grouped into clinically interpretable categories, including poor, below average, average, and good movement performance. The composite score was also analyzed as an ordinal or continuous functional-performance indicator, depending on the statistical requirement of each analysis. Lower FMS scores were interpreted as reflecting poorer movement quality and greater need for corrective assessment, but not as proof of future injury occurrence because the study design was cross-sectional (8,9).

The primary variables of interest were SLBT performance, NPRS pain intensity, and FMS composite score. SLBT repetitions represented hamstring performance, NPRS represented self-reported pain intensity, and FMS composite score represented overall functional movement quality. Secondary variables included demographic and training-related characteristics such as age, gender, body mass index category, training type, weekly training exposure, training-session duration, warm-up duration, and other available training-practice variables. Potential sources of bias included convenience sampling, self-reported pain, variability in training exposure, and possible influence of age, sex, maturation, prior symptoms, and sport participation patterns on movement performance. These limitations were addressed at the design and reporting level by applying defined eligibility criteria, using standardized assessment tools, maintaining consistent scoring procedures, and interpreting results as associations rather than causal effects.

Data were analyzed using SPSS version 26.0. Descriptive statistics were used to summarize demographic, training, pain, hamstring-performance, and functional-movement variables. Frequencies and percentages were reported for categorical variables, while continuous variables were summarized using mean and standard deviation or median and interquartile range depending on distributional characteristics. Normality of continuous variables was assessed using the Kolmogorov–Smirnov test. Because the data were not normally distributed, non-parametric Spearman's rho correlation coefficients were used to examine associations between SLBT performance, NPRS pain intensity, FMS composite score, and selected training-related variables. Correlation coefficients were interpreted according to their direction, magnitude, and statistical significance. A p-value of less than 0.05 was considered statistically significant. All inferential findings were interpreted cautiously because the study design did not allow causal inference or prediction of future injury risk.

To support reproducibility and data integrity, all participants were assessed using the same clinical tools, operational definitions, and scoring categories. Data were checked for completeness and consistency before analysis, and categorical groupings for NPRS, SLBT, and FMS were applied uniformly across the dataset. Any analysis involving association between clinical variables was based on the available recorded values for the relevant variables, and findings were reported as cross-sectional relationships rather than intervention effects or prognostic outcomes.

RESULTS

A total of 82 youth amateur football players were included in the analysis. The mean age of the participants was 16.2 ± 1.8 years, with the largest age groups being 14 years and 16 years, each representing 18 participants (22.0%). Male players constituted most of the sample, with 56 participants (68.3%), while 26 participants (31.7%) were female. Most participants had a normal body mass index, with 52 players (63.4%) classified within the 18–25 BMI category, whereas 25 players (30.5%) were underweight and 5 players (6.1%) were overweight. Regarding training characteristics, endurance training was the most frequently reported primary training type, reported by 30 players (36.6%), followed by strength training and sport-specific training, each reported by 26 players (31.7%). Weekly training exposure varied from 2 to 7 hours, with the highest proportion of players reporting 6 hours per week (n = 20, 24.4%), followed by 2 hours per week (n = 18, 22.0%) and 3 hours per week (n = 17, 20.7%). Training session duration most commonly ranged around 30 minutes, reported by 24 participants (29.3%), while warm-up duration was most commonly 10 minutes (n = 22, 26.8%) and 30 minutes (n = 17, 20.7%) (Table 1).

Table 1. Demographic and Training Characteristics of Participants (N = 82)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	12	1	1.2
	13	1	1.2
	14	18	22.0
	15	10	12.2
	16	18	22.0
	17	10	12.2
	18	13	15.9
	19	11	13.4
Gender	Male	56	68.3
	Female	26	31.7
BMI category	<18, underweight	25	30.5
	18–25, normal weight	52	63.4
	>25, overweight	5	6.1

Variable	Category	Frequency (n)	Percentage (%)
Primary training type	Strength training	26	31.7
	Endurance training	30	36.6
	Sport-specific training	26	31.7
Training hours/week	2	18	22.0
	3	17	20.7
	4	12	14.6
	5	7	8.5
	6	20	24.4
	7	8	9.8
Training duration/session (minutes)	10	9	11.0
	15	16	19.5
	20	4	4.9
	25	3	3.7
	30	24	29.3
	35	1	1.2
	40	6	7.3
	45	7	8.5
	50	3	3.7
	60	9	11.0
Warm-up duration (minutes)	0	3	3.7
	5	15	18.3
	10	22	26.8
	15	15	18.3
	20	7	8.5
	30	17	20.7
	60	3	3.7

Pain-intensity distribution showed that mild pain was the most common NPRS category, reported by 41 participants (50.0%), followed by moderate pain in 23 participants (28.0%). Seventeen players (20.7%) reported no pain at the time of assessment, while only one player (1.2%) reported pain in the severe range. SLBT performance showed that most players had suboptimal hamstring performance, with 46 participants (56.1%) classified in the average category and 31 participants (37.8%) classified in the poor category. Only 5 participants (6.1%) achieved good SLBT performance. Functional movement findings also indicated a high burden of movement-quality deficits. Based on FMS cumulative scores, 34 participants (41.5%) were classified as poor, 19 participants (23.2%) as below average, 23 participants (28.0%) as average, and only 6 participants (7.3%) as good. Overall, 53 participants (64.7%) scored below the average functional-movement range, indicating that nearly two-thirds of the sample demonstrated compromised movement quality on FMS assessment (Table 2).

Table 2. Clinical Outcome Distribution of Participants (N = 82)

Variable	Category	Frequency (n)	Percentage (%)	Cumulative Percentage (%)
NPRS pain intensity	No pain	17	20.7	20.7
	Mild pain, 1–3	41	50.0	70.7
	Moderate pain, 4–6	23	28.0	98.8
	Severe pain, 7–10	1	1.2	100.0
SLBT performance	Poor, ≤20 repetitions	31	37.8	37.8
	Average, 21–30 repetitions	46	56.1	93.9
	Good, >30 repetitions	5	6.1	100.0
FMS cumulative score	Poor, <10	34	41.5	41.5
	Below average, 10–13	19	23.2	64.7
	Average, 14–16	23	28.0	92.7
	Good, 17–21	6	7.3	100.0

Spearman's rho correlation analysis was performed because the main outcome variables were not normally distributed. SLBT performance demonstrated a strong negative correlation with NPRS pain intensity ($\rho = -0.691$, 95% CI: −0.790 to −0.558, $p < 0.001$), indicating that higher SLBT performance was associated with lower pain intensity. SLBT performance also showed a weak-to-moderate positive correlation with FMS cumulative score ($\rho = 0.303$, 95% CI: 0.092 to 0.488, $p = 0.006$), suggesting that better hamstring performance was associated with better functional movement quality. The relationship between NPRS pain intensity and FMS cumulative score was negative but did not reach conventional statistical significance (ρ = −0.215, 95% CI: −0.413 to 0.002, p = 0.052), indicating a possible inverse trend between pain and movement quality that should be interpreted cautiously. These findings show that SLBT performance had statistically significant associations with both pain intensity and functional movement quality, whereas pain intensity alone showed only a borderline association with FMS score (Table 3).

Table 3. Spearman's Correlations Among SLBT Performance, NPRS Pain Intensity, and FMS Cumulative Score (N = 82)

Variables	Correlation Direction	Spearman's ρ	95% CI	p-value
SLBT performance and NPRS pain intensity	Negative	−0.691	-0.790 to −0.558	<0.001
SLBT performance and FMS cumulative score	Positive	0.303	0.092 to 0.488	0.006
NPRS pain intensity and FMS cumulative score	Negative	−0.215	-0.413 to 0.002	0.052

Additional exploratory correlation analysis was conducted between SLBT performance and selected FMS components. SLBT performance showed statistically significant positive correlations with deep squat, hurdle step, active straight-leg raise, and rotary stability scores. The strongest association was observed between SLBT performance and active straight-leg raise (ρ = 0.760, 95% CI: 0.650 to 0.839, p < 0.001), indicating that players with better SLBT performance also tended to perform better on lower-limb mobility and posterior-chain-related movement control. The correlations with deep squat (ρ = 0.257, 95% CI: 0.042 to 0.449, p = 0.020) and hurdle step (ρ = 0.325, 95% CI: 0.116 to 0.506, p = 0.003) were weaker but statistically significant. Rotary stability demonstrated an extremely high correlation with SLBT performance (ρ = 0.988, 95% CI: 0.981 to 0.992, p < 0.001); however, because this magnitude is unusually high for clinical movement-screening data, this finding should be verified against the original dataset and coding procedure before being interpreted as a definitive clinical relationship (Table 4).

Table 4. Exploratory Correlations Between SLBT Performance and Selected FMS Components (N = 82)

FMS Component	Spearman's ρ with SLBT	95% CI	p-value
Deep squat	0.257	0.042 to 0.449	0.020
Hurdle step	0.325	0.116 to 0.506	0.003
Active straight-leg raise	0.760	0.650 to 0.839	<0.001
Rotary stability	0.988	0.981 to 0.992	<0.001

Training-related correlation analysis showed that FMS cumulative score had a weak negative correlation with training duration (ρ = −0.258, 95% CI: −0.450 to −0.043, p = 0.019), indicating that longer reported training duration was associated with slightly lower functional movement quality. In contrast, the association between cool-down duration and FMS cumulative score was weak and not statistically significant after recalculation using the reported coefficient and sample size (ρ = 0.181, 95% CI: −0.037 to 0.383, p = 0.104). Therefore, the previously stated significant relationship between cool-down duration and FMS should not be interpreted as statistically significant unless confirmed by the original SPSS output. These findings suggest that training exposure may be relevant to movement quality, but the observed associations were weak and should be interpreted with caution because training load was measured descriptively rather than through a detailed workload-monitoring model (Table 5).

Table 5. Correlations Between Training-Related Variables and FMS Cumulative Score (N = 82)

Variable	Spearman's ρ with FMS Cumulative Score	95% CI	p-value
Training duration	−0.258	-0.450 to −0.043	0.019
Cool-down duration	0.181	-0.037 to 0.383	0.104

Overall, the results indicate that lower hamstring performance, as reflected by poorer SLBT scores, was significantly associated with higher pain intensity and poorer functional movement quality among youth amateur football players. The strongest clinically interpretable association was observed between SLBT performance and NPRS pain intensity, followed by the association between SLBT performance and FMS cumulative score. The high proportion of participants with poor or below-average FMS scores, combined with the predominance of poor-to-average SLBT performance, suggests that hamstring performance and movement quality should be considered together during screening and conditioning of youth football players. However, all findings should be interpreted as cross-sectional associations rather than evidence of causality, intervention effectiveness, or future injury prediction.

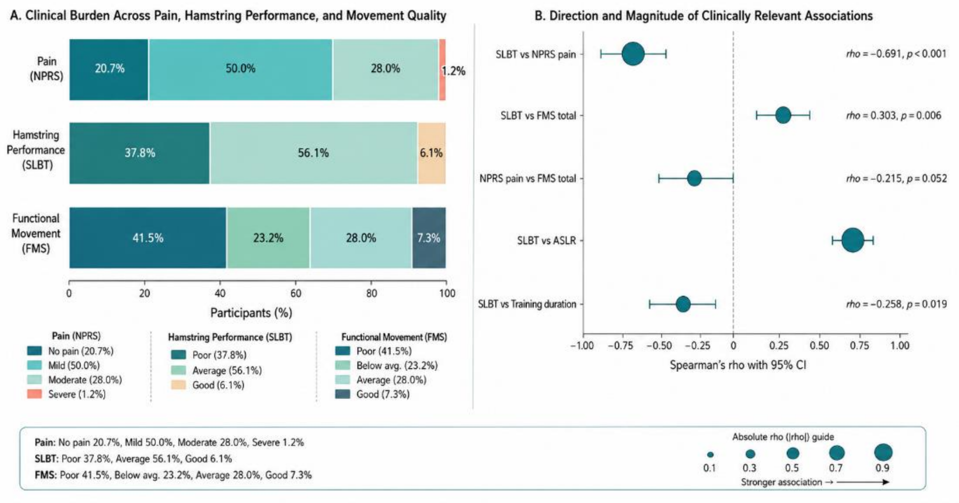

Figure 1. Integrated Profile of Hamstring Performance, Pain, and Functional Movement in Youth Amateur Football Players

The paneled figure demonstrates that clinical deficits clustered across pain, hamstring performance, and functional movement domains. Pain was common but generally low to moderate, with 50.0% of players reporting mild pain and 28.0% reporting moderate pain, while only 1.2% reported severe pain. Hamstring performance was predominantly suboptimal, as 37.8% of players showed poor SLBT performance and 56.1% showed average performance, leaving only 6.1% in the good-performance category. Functional movement deficits were similarly prominent, with 41.5% of participants classified as poor and 23.2% as below average on FMS, indicating that 64.7% of the sample had below-average movement quality. The association panel further shows that higher SLBT performance was strongly associated with lower pain intensity ($\rho = -0.691$, 95% CI: −0.790 to −0.558, $p < 0.001$) and moderately associated with better FMS composite scores ($\rho = 0.303$, 95% CI: 0.092 to 0.488, $p = 0.006$). The strongest component-level association was observed between SLBT and active straight-leg raise performance ($\rho = 0.760$, 95% CI: 0.650 to 0.839, $p < 0.001$), supporting the clinical relevance of posterior-chain function in lower-limb movement quality.

DISCUSSION

The present study examined the association of Single Leg Bridge Test performance with pain intensity and functional movement quality among youth amateur football players. The findings showed that lower SLBT performance was significantly associated with higher NPRS pain intensity, while better SLBT performance was positively associated with higher FMS cumulative scores. These results support the clinical relevance of field-based hamstring assessment in young football players, particularly in settings where advanced strength-testing equipment may not be available. The predominance of poor-to-average SLBT performance, together with the high proportion of players scoring below average on FMS, suggests that hamstring endurance and posterior-chain control may be important components of routine screening in this population. However, because the study used a cross-sectional design, these findings should be interpreted as associations rather than evidence that hamstring weakness directly causes pain or movement deficits.

The negative association between SLBT performance and pain intensity is consistent with the broader literature identifying hamstring weakness as an important modifiable factor in football-related lower-limb problems. Previous evidence has shown that hamstring injuries remain common in running-based and field sports, with recurrence frequently reported after return to play when strength deficits are not adequately restored (2,7). More recent professional football data have also indicated an increasing burden of hamstring injuries, emphasizing the continuing importance of hamstring-specific screening, prevention, and rehabilitation strategies in football populations (3). Although the present study did not prospectively evaluate injury occurrence, the observed relationship between lower SLBT performance and higher pain intensity suggests that players with reduced hamstring performance may experience greater symptom burden during football participation. This finding highlights the practical value of simple clinical tests that can be used by physiotherapists, trainers, and coaches to identify athletes who may benefit from further musculoskeletal assessment.

The positive association between SLBT performance and FMS cumulative score indicates that hamstring performance may be related not only to localized pain but also to broader movement quality. Football requires repeated acceleration, deceleration, kicking, landing, cutting, and trunk-pelvic control, all of which depend on coordinated function across the posterior chain and lower limb. Prior research has demonstrated relationships between hamstring strength, sprinting ability, jumping performance, and change-of-direction capacity in young athletes, supporting the idea that hamstring function contributes to global athletic performance rather than acting as an isolated muscle factor (4,5). The present findings are therefore clinically plausible, as players with better hamstring performance may also demonstrate better control during functional movement tasks requiring hip stability, knee control, posterior-chain extensibility, and trunk-pelvic coordination.

The strongest component-level association was observed between SLBT performance and active straight-leg raise performance. This relationship may reflect the shared contribution of posterior-chain flexibility, lumbopelvic control, and hamstring function to both tests. The active straight-leg raise component of the FMS requires controlled hip flexion, contralateral limb stability, and adequate posterior-chain mobility, while the SLBT requires repeated hip extension control and endurance in a single-limb position. A strong association between these measures is therefore clinically meaningful, although it should still be interpreted cautiously because component-level correlations may be influenced by scoring distribution, ordinal scaling, and the limited range of FMS component scores. The extremely high correlation reported between SLBT and rotary stability should be verified against the original dataset and coding procedure before being treated as a definitive clinical finding, as correlations of this magnitude are uncommon in clinical movement-screening research.

The high frequency of poor and below-average FMS performance is an important finding for youth football practice. Nearly two-thirds of participants scored below the average functional-movement category, indicating that movement-quality limitations were common in this sample. This aligns with research suggesting that movement deficits may be prevalent among youth athletes and may reflect the combined influence of growth, training exposure, neuromuscular control, and sport-specific demands (18,19). However, FMS findings should not be interpreted as a standalone prediction of injury risk, especially in a cross-sectional design. Instead, lower FMS scores should be viewed as indicators of movement patterns that may require closer clinical evaluation, corrective exercise, strength development, mobility work, and training-load review.

Training-related findings showed a weak negative association between training duration and FMS cumulative score. This suggests that greater reported training exposure may not necessarily correspond to better movement quality, particularly if training is not supported by adequate recovery, movement correction, strength progression, and load monitoring. Previous evidence has emphasized that the relationship between training load and injury risk in youth football is complex and may depend on load fluctuation, monotony, recovery capacity, maturation status, and individual physical preparedness (20). In the present study, training exposure was assessed descriptively rather than through detailed workload monitoring; therefore, the observed association should be interpreted cautiously. Future studies should include more precise training-load measures, such as session frequency, session rating of perceived exertion, acute-to-chronic workload indicators, recovery status, and playing position.

This study has several limitations. The cross-sectional design prevents causal inference and does not allow conclusions about whether hamstring weakness leads to pain, whether pain reduces SLBT performance, or whether both are influenced by other factors. Convenience sampling may limit generalizability to other youth football populations. The study did not adjust for potentially important confounders such as biological maturation, limb dominance, previous injury history, playing position, sex-specific training exposure, strength training history, or match participation level. Pain was self-reported, and functional movement scoring may be influenced by assessor judgment unless strict inter-rater reliability procedures are applied. The use of field-based tests improves clinical feasibility but does not provide direct measurement of maximal eccentric hamstring strength. Despite these limitations, the study provides useful preliminary evidence that SLBT performance is meaningfully associated with both pain intensity and functional movement quality in youth amateur football players.

Future research should use longitudinal or interventional designs to determine whether targeted hamstring strengthening and movement-correction programs can improve SLBT performance, reduce pain, and enhance FMS scores over time. Studies with larger samples should also examine sex differences, playing-position demands, maturation status, previous injury history, and workload patterns. Combining field-based tools such as SLBT and FMS with objective strength measures, sprint testing, and follow-up injury surveillance may provide a more complete understanding of how hamstring function contributes to performance and musculoskeletal health in youth football.

CONCLUSION

This study found that poorer Single Leg Bridge Test performance was significantly associated with higher pain intensity and lower functional movement quality among youth amateur football players. Most participants demonstrated poor-to-average hamstring performance and a high proportion showed below-average FMS scores, indicating that posterior-chain function and movement quality may require greater attention during screening and conditioning in this population. These findings support the use of SLBT and FMS as practical field-based tools for identifying players who may benefit from targeted strengthening, mobility training, and movement-correction strategies. However, because the study was cross-sectional, the findings should be interpreted as associations only, and further longitudinal and interventional research is needed to determine whether improving hamstring performance can reduce pain or enhance functional movement outcomes.

REFERENCES

1. De Freitas FH, Neto VG, Paz GA, dos Santos DT, Dantas EHM, Gonçalves MM, et al. Correlation between lower limb asymmetry and performance in professional female soccer players. Motricidade. 2024;20(3).

2. Oleksy Ł, Mika A, Pacana J, Markowska O, Stolarczyk A, Kielnar R. Why is hamstring strain injury so common in sport despite numerous prevention methods? Are there any missing pieces to this puzzle? Front Physiol. 2021;12:586624.

3. Ekstrand J, Bengtsson H, Waldén M, Davison M, Khan KM, Hägglund M. Hamstring injury rates have increased during recent seasons and now constitute 24% of all injuries in men's professional football: the UEFA Elite Club Injury Study from 2001/02 to 2021/22. Br J Sports Med. 2023;57(5):292-8.

4. Jiang D, Liu Z, Ling X, Dai J, Long L, Lu Y, et al. Investigating the impact of inter-limb asymmetry in hamstring strength on jump, sprint, and strength performance in young athletes: comparing the role of gross force. Front Physiol. 2023;14:1185397.

5. Markovic G, Sarabon N, Boban F, Zoric I, Jelcic M, Sos K, et al. Nordic hamstring strength of highly trained youth football players and its relation to sprint performance. J Strength Cond Res. 2020;34(3):800-7.

6. Freeman BW, Young WB, Talpey SW, Smyth AM, Pane CL, Carlon TA. The effects of sprint training and the Nordic hamstring exercise on eccentric hamstring strength and sprint performance in adolescent athletes. J Sports Med Phys Fitness. 2019;59(7):1119-25.

7. Green B, Bourne MN, Van Dyk N, Pizzari T. Recalibrating the risk of hamstring strain injury: a 2020 systematic review and meta-analysis of risk factors for index and recurrent hamstring strain injury in sport. Br J Sports Med. 2020;54(18):1081-8.

8. Claudino JG, Cardoso Filho CA, Bittencourt NFN, Gonçalves LG, Couto CR, Quintão RC, et al. Eccentric strength assessment of hamstring muscles with new technologies: a systematic review of current methods and clinical implications. Sports Med Open. 2021;7(1):10.

9. Ishøi L, Krommes K, Nielsen MF, Thornton KB, Hölmich P, Aagaard P, et al. Hamstring and quadriceps muscle strength in youth to senior elite soccer: a cross-sectional study including 125 players. Int J Sports Physiol Perform. 2021;16(10):1538-44.

10. Mandorino M, Figueiredo AJ, Gjaka M, Tessitore A. Injury incidence and risk factors in youth soccer players: a systematic literature review. Part I: epidemiological analysis. Biol Sport. 2023;40(1):3-25.

11. Walker EJ, Aughey RJ, McLaughlin P, McAinch AJ. Seasonal change in body composition and physique of team sport athletes. J Strength Cond Res. 2022;36(2):565-72.

12. Morgans R, Orme P, Bezuglov E, Di Michele R. Technical and physical performance across five consecutive seasons in elite European soccer. Int J Sports Sci Coach. 2023;18(3):839-47.

13. Moore E, Fuller JT, Milanese S, Jones SC, Townsley A, Lynagh M, et al. Does changing the Functional Movement Screen composite score threshold influence injury risk estimation in junior Australian football players? J Sports Sci. 2023;41(1):20-6.

14. Raya-González J, Clemente FM, Castillo D. Analyzing the magnitude of interlimb asymmetries in young female soccer players: a preliminary study. Int J Environ Res Public Health. 2021;18(2):475.

15. Mahnič N, Rauter S, Hadžić V, Šimenko J. The Single Leg Bridge Test as a field test to measure hamstring strength in young footballers. Sci Sports. 2021;36(5):417.e1-417.e7.

16. Modarresi S, Lukacs MJ, Ghodrati M, Salim S, MacDermid JC, Walton DM. A systematic review and synthesis of psychometric properties of the numeric pain rating scale and the visual analog scale for use in people with neck pain. Clin J Pain. 2022;38(2):132-48.

17. Martín-Moya R, Rodríguez-García L, Moreno-Vecino B, Clemente FM, González AL, González-Fernández FT. Differences and relationship in Functional Movement Screen scores and physical fitness in male and female semi-professional soccer players. PeerJ. 2023;11.

18. Zarei M, Soltanirad S, Kazemi A, Hoogenboom BJ, Hosseinzadeh M. Composite Functional Movement Screen score predicts injuries in youth volleyball players: a prospective cohort study. Sci Rep. 2022;12(1):20207.

19. Towlson C, Salter J, Ade JD, Enright K, Harper LD, Page RM, et al. Maturity-associated considerations for training load, injury risk, and physical performance in youth soccer: one size does not fit all. J Sport Health Sci. 2021;10(4):403-12.

20. Verstappen S, van Rijn RM, Cost R, Stubbe JH. The association between training load and injury risk in elite youth soccer players: a systematic review and best evidence synthesis. Sports Med Open. 2021;7(1):6.