The effects of the FIFA 11+ program on lower limb functional outcomes: A systematic review

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ABSTRACT

Background: The FIFA 11+ program has been proven effective in preventing soccer injuries, but evidence regarding its impact on lower extremity functional outcomes is still scattered and reported heterogeneously.

Objectives: This systematic review aims to synthesize evidence regarding the effects of the FIFA 11+ program on lower extremity functional outcomes—including ROM, knee extension, internal and external hip rotation, and hamstring muscle strength—in athletes.

Methods: This systematic review was prospectively registered in PROSPERO (CRD420251147261) and conducted in accordance with PRISMA 2020 guidelines. A total of 14 studies involving athletes or physically active individuals met the inclusion criteria. Functional outcomes were measured using various instruments, primarily an isokinetic dynamometer for muscle strength and a goniometer for ROM measurement. The methodological quality of the studies was assessed using the Newcastle–Ottawa Scale. Due to substantial heterogeneity in study design, measurement instruments, intervention protocols, and reporting formats, a quantitative meta-analysis was not performed, and the data were synthesized using a qualitative narrative approach.

Results: Most studies (approximately 70–80%) reported an increase in hamstring muscle strength after the FIFA 11+ intervention, particularly in concentric and eccentric isokinetic measurements. Improvements in ROM and functional outcomes of the knee and hip were also reported, although results varied between studies. Evidence related to knee extension and hip rotation shows lower consistency compared to hamstring strength.

Conclusions: The FIFA 11+ program shows potential functional benefits beyond injury prevention, particularly in improving hamstring muscle strength and several aspects of joint mobility.

Keywords: FIFA 11+, hamstring strength, injury prevention, lower limb function, range of motion.

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INTRODUCTION

Lower limb injuries remain a prevalent concern in athletic populations, particularly in sports involving sprinting, cutting, and rapid changes of direction, such as football. These injuries not only contribute to time loss and reduced performance but are also closely associated with deficits in lower limb functional capacities, including joint range of motion (ROM), muscle strength, and neuromuscular control (Bahr & Krosshaug, 2005; Pun, 2020).

The FIFA 11+ program was chosen as the focus of this systematic review because it is the most widely implemented injury prevention program globally, developed directly by the FIFA Medical Assessment and Research Center (F-MARC), and supported by empirical evidence across countries, ages, and competition levels. Compared to other programs such as HarmoKnee, PEP, or KIPP, FIFA 11+ has advantages in terms of protocol standardization, ease of implementation without special equipment, and official adoption by national and international football federations (Bizzini & Dvorak, 2015; Daneshjoo et al., 2012). Additionally, several comparative studies indicate that FIFA 11+ provides neuromuscular effects that are equivalent to or superior to alternative programs, particularly in terms of hamstring strength and knee control, which are relevant for the prevention of lower extremity injuries (Ayala et al., 2017; Daneshjoo et al., 2013).

Accordingly, the FIFA 11+ program has been widely promoted as an evidence-based warm-up protocol to reduce injury risk (Arsenis et al., 2020; Ayala et al., 2017; Bizzini & Dvorak, 2015; García-Solano et al., 2019; Sumartiningsih et al., 2022; Zhou et al., 2022). While its effectiveness in lowering injury incidence has been consistently demonstrated, the extent to which the FIFA 11+ program influences lower limb functional outcomes remains less clearly understood (Bizzini & Dvorak, 2015).

Several primary studies have examined the effects of the FIFA 11+ program on outcomes such as ROM, hamstring muscle strength, and joint-specific functional measures. However, findings across these studies are heterogeneous, with substantial variability in study design, outcome definitions, measurement protocols, and comparator conditions. Previous reviews have predominantly focused on injury incidence, with limited attention given to functional adaptations that may underpin injury risk reduction and performance enhancement (Impellizzeri et al., 2013; Mendiguchia & Brughelli, 2011). To date, no systematic review has comprehensively synthesized evidence on the effects of the FIFA 11+ program specifically on lower limb functional outcomes, representing a clear gap in the literature.

To date, most systematic reviews of the FIFA 11+ program have focused on injury prevention effectiveness, with a primary focus on indicators such as injury incidence, risk ratio, and implementation compliance rate, rather than on changes in lower extremity functional outcomes. Several reviews indicate that FIFA 11+ consistently reduces the risk of injury in soccer players across various age groups and competition levels, but the synthesis is almost entirely based on injury outcomes, rather than physical function as the primary outcome (Barengo et al., 2014; Gomes Neto et al., 2017; Robles-Palazón et al., 2024). Even when performance or physical capacity aspects are discussed, these indicators are generally presented in aggregate or mixed with injury outcomes, without clear separation of specific functional adaptations.

Furthermore, although several studies have examined the effects of FIFA 11+ on biomechanical and neuromuscular responses, strength, agility, and dynamic stability,

these investivigations were not designed to synthesize lower extremity functional outcomes exclusively, but rather combined various general performance indicators with diverse designs and instruments (Foqha et al., 2023). Consequently, evidence regarding specific functional changes—such as hamstring strength measured with an isokinetic dynamometer, joint range of motion measured with a goniometer, and knee extension and hip rotation—remains scattered and has not been integrated into a focused synthesis.

Based on these conditions, there is a clear research gap, namely the absence of a systematic review that explicitly and exclusively focuses its analysis on lower extremity functional outcomes as the main result, separate from injury incidence. Therefore, the main contributions of this systematic review are (1) to present a structured synthesis of lower extremity functional adaptations resulting from the implementation of FIFA 11+, and (2) to emphasize the conceptual difference between injury incidence-based reviews and function-based reviews, thereby providing a more comprehensive understanding of the role of FIFA 11+ not only as an injury prevention program, but also as an intervention that has the potential to significantly modify the functional capacity of athletes.

METHODS

The review protocol was prospectively registered in the International Prospective Register of Systematic Reviews (PROSPERO; CRD420251147261) and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). Ethical approval was not required because this study did not involve individual-level participant data.

Search Strategy

A systematic literature search was conducted in the Scopus and PubMed databases. The search strategy was developed based on the PICOS framework and combined using Boolean operators ("AND," "OR"). The main search strings used were as follows:

("FIFA 11+" OR "FIFA eleven plus" OR "11+ injury prevention") AND ("lower limb function" OR "range of motion" OR ROM OR "hamstring strength" OR "knee extension" OR "hip rotation" OR "neuromuscular performance") AND ("athlete" OR "soccer player" OR "football player" OR "sport").

The search was limited to peer-reviewed articles in English that were available in full text. There were no restrictions on publication year to ensure comprehensive literature coverage. The search strategy was slightly adjusted to the characteristics of each database to maximize search sensitivity.

Study Selection and Eligibility Criteria

Study selection was guided by predefined inclusion and exclusion criteria based on the PICOS framework. Eligible studies included original research articles employing randomized controlled trials, controlled trials, cohort studies, or quasi-experimental designs. Participants were required to be athletes or physically active individuals, regardless of age, sex, or competitive level.

Studies were included if they implemented the FIFA 11+ program (full or modified versions) and compared it with standard training, usual warm-up routines, or no specific injury-prevention intervention. To be eligible, studies had to report at

least one relevant lower limb functional outcome, including range of motion, knee extension, hip internal or external rotation, or hamstring muscle strength.

Studies were excluded if they were reviews, editorials, conference abstracts without full text, case studies, or single-subject reports. Articles focusing solely on injury incidence without reporting functional or strength-related outcomes, studies not involving the FIFA 11+ program, and non-English publications were also excluded.

Screening and Data Extraction

The study selection process was conducted in several stages in accordance with the PRISMA 2020 guidelines (Figure 1). Two independent reviewers separately screened the titles and abstracts to identify relevant studies. Studies that passed the initial stage were then reviewed in full text by the same two reviewers to ensure compliance with the established inclusion and exclusion criteria. Any differences of opinion between reviewers were resolved through discussion until consensus was reached. If necessary, the final decision was made through joint discussion.

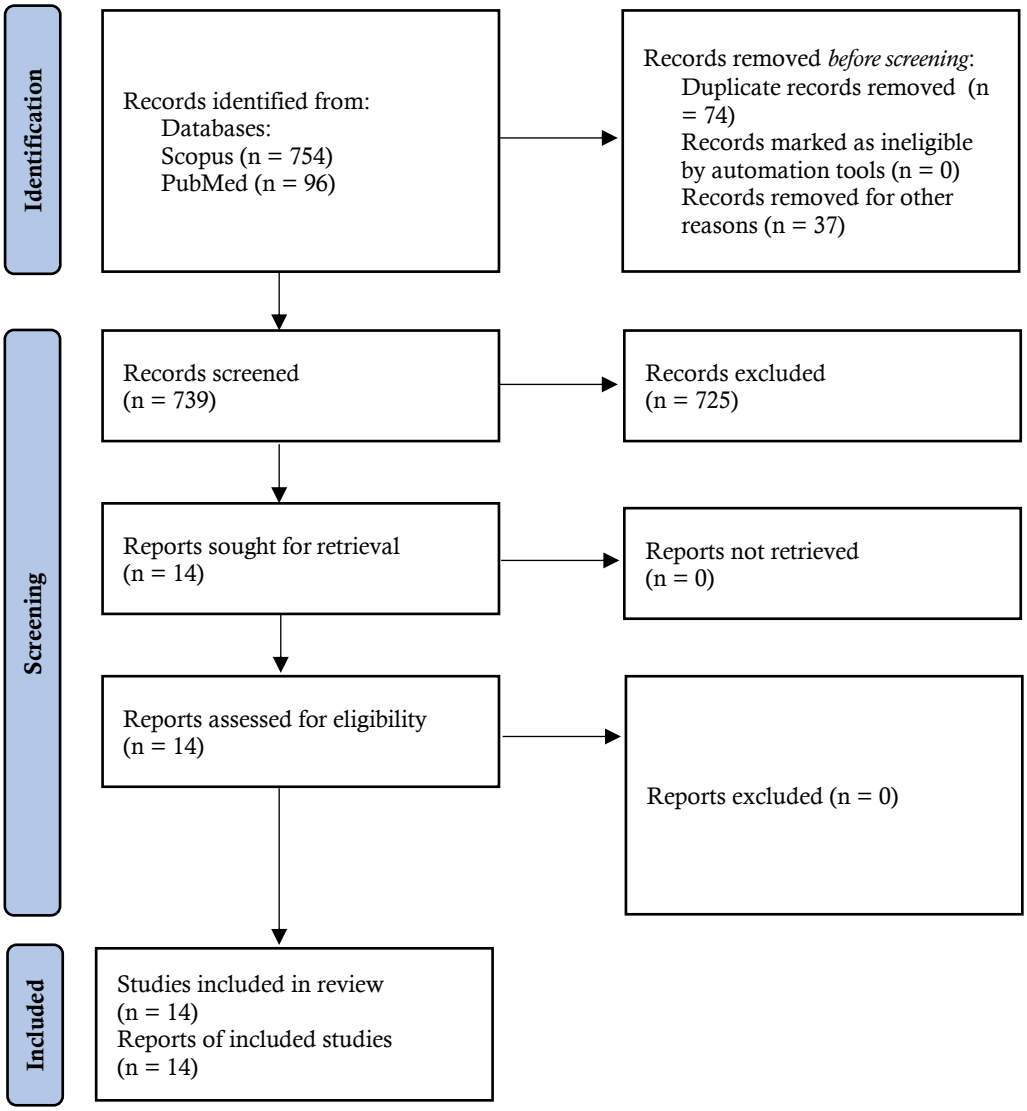

Figure 1. PRISMA flow chart was used to identify of the include studies

Quality Assessment

The methodological quality and risk of bias of the included studies were evaluated using the Newcastle–Ottawa Scale (NOS). NOS was chosen because it allows for consistent and transparent assessment across heterogeneous study designs, including randomized and non-randomized studies, which form the basis of the evidence included in this review.

The NOS evaluates study quality in three domains: study group selection, group equivalence, and outcome assessment. Each study is assigned a maximum score of nine points. Studies with a score of 7–9 points are classified as having a low risk of bias, scores of 5–6 points as moderate risk, and studies with a score of ≤4 points as high risk of bias.

The quality assessment was conducted to support the interpretation of findings and provide an overview of the rigor of the available evidence methodology. The results of the quality assessment are presented in Table 1.

Table 1. Summary of Methodological Quality using the Newcastle–Ottawa Scale (NOS)

Author / Year	Selection	Comparability	Outcome	Total	Risk of Bias
Arsenis et al. (2020)	3	1	2	6	Moderate
Ayala et al. (2017)	3	1	2	6	Moderate
Brito et al. (2010)	3	0	2	5	Moderate
Bukry et al. (2024)	3	1	2	6	Moderate
Ghareeb et al. (2017)	4	1	2	7	Low
Daneshjoo et al. (2012)	3	1	2	6	Moderate
Grooms et al. (2013)	4	2	2	8	Low
Zhou et al. (2022)	3	1	2	6	Moderate
Daneshjoo et al. (2013)	4	2	2	8	Low
Oshima et al. (2019)	3	1	2	6	Moderate
Veith et al. (2021)	3	1	2	6	Moderate
Impellizzeri et al. (2013)	4	2	2	8	Low
Panchal et al. (2025)	3	1	3	7	Low
Soussi et al. (2025)	3	1	2	6	Moderate

The Newcastle–Ottawa Scale (NOS) evaluates study quality based on three domains: selection (maximum 4 points), comparability (maximum 2 points), and outcome assessment (maximum 3 points). Studies scoring 7–9 points were considered low risk of bias, 5–6 points moderate risk, and ≤4 points high risk of bias

Data Synthesis and Analysis

Due to substantial heterogeneity across studies in terms of study design, comparator types, outcome definitions, measurement methods, and reporting formats, a quantitative meta-analysis was not feasible. Therefore, a qualitative narrative synthesis was conducted.

Findings were synthesized and reported according to outcome categories, including range of motion, knee extension, hip internal and external rotation, and hamstring muscle strength. Patterns of results, direction of effects, and potential mechanisms underlying observed changes were discussed. This approach allowed for a comprehensive interpretation of the evidence while maintaining methodological rigor and transparency.

RESULTS

Study Selection

The study selection process is summarized in the PRISMA 2020 flow diagram. A total of 850 records were identified through database searching (Scopus and

PubMed). After removing duplicate records and records excluded for other reasons (n = 111), 739 records were screened based on titles and abstracts. Of these, 725 records were excluded as they did not meet the predefined inclusion criteria. The remaining 14 full-text articles were assessed for eligibility, and all were deemed eligible and included in the qualitative synthesis. No full-text articles were excluded at the eligibility stage.

Study Characteristics

The 14 included studies comprised a range of experimental and quasi-experimental designs, including randomized controlled trials and controlled intervention studies. Participants were predominantly athletes or physically active individuals, with most studies involving soccer players, reflecting the original target population of the FIFA 11+ program. Study durations varied across investigations, ranging from short-term interventions to multi-week training programs.

Interventions consisted of the full FIFA 11+ program or modified versions, while comparators included usual warm-up routines, standard training, or alternative warm-up protocols. Outcome assessments were conducted pre- and post-intervention, with post-intervention values prioritized for synthesis. Overall, the included studies represented diverse populations, intervention durations, and comparator conditions, contributing to methodological heterogeneity.

Outcome Characteristics

The included studies reported a variety of lower limb functional outcomes, including range of motion (ROM), knee extension, hip internal and external rotation, and hamstring muscle strength. ROM outcomes were commonly assessed using goniometric measurements, either under passive conditions or during weight-bearing tasks. Muscle strength outcomes were predominantly evaluated using isokinetic dynamometry, with angular velocities varying across studies.

Hamstring muscle strength was the most frequently reported outcome, followed by joint ROM measures. Considerable heterogeneity was observed in outcome definitions, measurement instruments, testing protocols, and reporting formats. This variability limited direct quantitative comparison across studies and supported the use of a qualitative narrative synthesis approach.

Summary of Methodological Quality

The methodological quality of the included studies, assessed using the Newcastle–Ottawa Scale (NOS), ranged from moderate to low risk of bias. Overall, the majority of studies demonstrated moderate methodological quality, with total NOS scores typically between 5 and 6 points, indicating acceptable rigor for narrative synthesis. Several studies achieved higher quality ratings (NOS scores $\geq$7), reflecting stronger methodological characteristics, particularly in terms of participant selection and outcome assessment.

Across the included studies, the selection domain generally received favorable scores, as most investigations clearly defined eligibility criteria and employed appropriate participant recruitment methods. In contrast, comparability between groups was a recurring methodological limitation, as many studies did not fully control for potential confounding variables or lacked rigorous randomization procedures. The outcome domain was commonly rated as moderate, with most studies reporting validated measurement tools and post-intervention outcomes, although blinding of outcome assessors was infrequently described.

Taken together, the quality assessment suggests that the included evidence provides a reasonable methodological foundation for qualitative synthesis, while highlighting the need for future studies with improved control of confounding factors and more robust experimental designs.

Narrative Synthesis of Outcomes

Overall, the narrative synthesis indicated that the FIFA 11+ program was associated with improvements in lower limb functional outcomes across multiple domains. Several studies reported increases in hamstring muscle strength, particularly when assessed using isokinetic protocols, suggesting favorable neuromuscular adaptations. Improvements in joint range of motion, including hip and knee-related measures, were also observed, although the magnitude and consistency of effects varied across studies.

The heterogeneity in study design, intervention implementation, outcome measures, and comparator conditions precluded quantitative pooling of results. Nevertheless, the direction of findings across studies generally supported a beneficial role of the FIFA 11+ program in enhancing lower limb functional performance. These findings provide a coherent qualitative evidence base while highlighting the need for future studies employing standardized outcome measures and more rigorous experimental designs.

Table 2 summarizes the key characteristics of the included studies. The studies employed a range of experimental and quasi-experimental designs and predominantly involved soccer players or physically active athletes. Intervention durations varied across studies, and the FIFA 11+ program was implemented either in its original or modified form. Comparators included usual warm-up routines, standard training, or alternative warm-up programs. Across studies, outcomes commonly assessed included hamstring muscle strength and joint range of motion, measured using various instruments and testing protocols.

Table 2. Study Characteristics

Author (Year)	Study Design	Country / Setting	Participants (n, age, sex, level)	Intervention (FIFA 11+ version)	Comparator	Frequency & Duration	Outcomes – Injury	Outcomes – Functional	Conclusion
Arsenis et al. (2020)	Randomized controlled trial (parallel-group, pre–post)	Greece; competitive male soccer players	n = 32; 19 ± 1 yrs; male; competitive youth/young adult soccer players	FIFA 11+ (Level 2 injury prevention warm-up)	Usual / conventional warm-up	3 sessions/week for 8 weeks (~20–25 min/session)	Injury incidence not directly measured; injury risk inferred via neuromuscular and balance outcomes	Balance (Biodex Stability Index); isokinetic knee strength (concentric & eccentric flexors/extensors); H/Q ratio	FIFA 11+ effectively improves balance and hamstring strength, which are key functional components for lower-limb injury prevention
Ayala et al. (2017)	Randomized controlled trial (parallel-group, pre–post, double baseline)	Spain; youth amateur football clubs (Spanish Football Federation league)	n = 41 male youth soccer players; age 16.8 ± 0.7 years; amateur level	FIFA 11+ (full program, Part 1–3; Part 2 at Level II difficulty)	Traditional warm-up (control) and HarmoKnee program	3×/week; ~20–25 min/session; 4 weeks (12 sessions)	Injury outcomes not measured directly	Dynamic balance (Y-Balance), single-leg hop symmetry, sprint (10 & 20 m), vertical drop jump, agility, ROM	Short-term implementation of FIFA 11+ improves neuromuscular performance and functional outcomes linked to injury risk reduction in youth male soccer players
Brito et al. (2010)	Pre–post intervention study (single group, non-randomized)	Portugal (sub-elite soccer clubs; mid-season)	n = 20 male soccer players (18 completed); mean age 22.3 ± 4.2 yrs; sub-elite level	FIFA 11+ (full program: Part 1 running + Part 2 strength/plyometric/balance + Part 3 speed & change of direction)	None (no control group)	3×/week for 10 weeks (mean compliance 73%)	Not assessed directly (injury incidence not measured)	Isokinetic knee strength (hamstrings & quadriceps), H/Q ratio, Dynamic Control Ratio (DCR)	FIFA 11+ improves knee flexor strength and muscle balance, particularly eccentric hamstring strength, which may reduce knee and hamstring injury risk
Bukry et al. (2024)	Quasi-experimental pre–post with control group	Malaysia; secondary school / laboratory setting	n = 30 male youth soccer players; mean age 16.0 ± 0.9 yrs; recreational/high school level	Standard FIFA 11+ warm-up (3 parts: running, strength–balance–jumping, speed & football-specific drills)	Usual unstructured warm-up	2×/week for 8 weeks	ACL injury risk markers assessed via Landing Error Scoring System (LESS) during fatigue	Isokinetic knee strength (hamstring & quadriceps concentric/eccentric); H/Q conventional & functional ratios; landing biomechanics (LESS)	FIFA 11+ for 8 weeks improves landing biomechanics related to ACL injury risk under fatigue, but does not significantly enhance lower-limb muscle strength

Table 2. (Continued)

Author (Year)	Study Design	Country / Setting	Participants (n, age, sex, level)	Intervention (FIFA 11+ version)	Comparator	Frequency & Duration	Outcomes – Injury	Outcomes – Functional	Conclusion
Ghareeb et al. (2017)	Quasi-experimental, pre–post comparison	USA; High school soccer teams	n = 34 male players; age 14–18 years (mean 16.5); high school level	FIFA 11+ (standard version, supervised by coach)	New Warm-up Program (NWP) emphasizing balance & strength	3×/week, 20 min/session, 6 weeks	Not assessed	Balance (Biodex Stability Index), isokinetic knee strength (quadriceps & hamstrings at 60°, 180°, 300°/s)	FIFA 11+ improves isokinetic knee strength modestly but does not significantly enhance balance over 6 weeks; less effective than NWP for neuromuscular outcomes
Daneshjoo et al. (2012)	Randomized controlled trial (3-arm parallel)	Iran; professional soccer clubs	n = 36 male players; age 17–20 years; professional / U21	FIFA 11+ (standard F-MARC version: running, strength, balance, plyometric, eccentric hamstring, core stability)	HarmoKnee program; Control (usual warm-up)	3×/week; 20–25 min/session; 8 weeks (24 sessions)	Indirect injury risk markers: CSR, DCR, FSR (knee injury risk indicators)	Isokinetic knee flexor/extensor strength ratios (CSR, DCR, FSR)	FIFA 11+ improves knee strength ratios associated with injury risk; HarmoKnee showed no significant improvements
Grooms et al. (2013)	Prospective cohort study (non-randomized)	USA, NCAA Division III collegiate soccer team	n = 41 male players; age 18–25 years; collegiate level	FIFA 11+ (F-MARC 11+), full program with progression and supervision by certified athletic trainer	Traditional dynamic warm-up (referent season)	~20 min/session; before every practice & match; preseason + in-season (12 weeks); 5–6×/week	Lower extremity injury incidence; injury rate per 1000 exposures; days lost due to injury	Not directly assessed (no biomechanical or performance tests)	Supervised FIFA 11+ significantly reduced lower limb injury risk and injury severity in collegiate male soccer players
Zhou et al. (2022)	Randomized controlled trial	China (youth soccer academy)	n = 20 male youth soccer players; mean age 12–13 years; U14; field players	FIFA 11+ (standard full program: part 1–3)	Traditional warm-up	3×/week; 8 weeks; 20 min/session	Not assessed (no injury incidence reported)	Knee flexor & extensor isometric strength; H/Q ratio; 30-m sprint; 5×25-m shuttle run	FIFA 11+ improves knee flexor strength, strength balance (H/Q), and running performance in adolescent soccer players

Table 2. (Continued)

Author (Year)	Study Design	Country / Setting	Participants (n, age, sex, level)	Intervention (FIFA 11+ version)	Comparator	Frequency & Duration	Outcomes – Injury	Outcomes – Functional	Conclusion
Daneshjoo et al. (2013)	Randomized controlled trial (three-arm)	Malaysia & Iran (professional soccer clubs)	n = 36 male professional soccer players; age 17–20 years; elite / U-21 level	FIFA 11+ (full program)	HarmoKnee program; Control (usual warm-up)	3×/week; 20–25 min/session; 8 weeks	Not reporting direct injury incidents	Isokinetic knee strength (quadriceps & hamstrings, concentric & eccentric at 60°, 180°, 300°/s)	FIFA 11+ is more effective at improving concentric hamstring strength than HarmoKnee and control in young professional soccer players.
Oshima et al. (2020)	Case series (Level IV)	Japan; university setting	n = 8; mean age 20.4 ± 0.5 years; male; collegiate soccer players	FIFA 11+ Part 2 only (strength, balance, plyometrics, core stability)	None (pre–post design)	≥3 sessions/week for 6 months	Injury incidence not directly measured (injury risk inferred)	Muscle activity (FDG-PET), isokinetic knee strength, static & dynamic balance (SEBT)	Long-term routine performance of FIFA 11+ Part 2 improves core & lower limb muscle activation, knee flexor strength, and dynamic balance, potentially reducing injury risk
Veith et al. (2021)	Matched-paired randomized controlled trial (one-club RCT)	United Kingdom; elite academy football club	n = 65 elite male academy players; adolescents (U16–U18); competitive academy level	FIFA 11+ – Part 2 only (strength, balance, plyometrics), delivered home-based (HG) or training-ground based (TG)	Comparison between delivery modes (home vs training); no non-intervention control	3×/week; full competitive season (longitudinal, repeated measures across season)	Time-loss injuries; medical-attention injuries	Eccentric hamstring strength (NordBord), countermovement jump height (CMJ), time-to-stabilisation (TTS)	Delivering FIFA 11+ Part 2 at home is as effective as supervised delivery for improving hamstring strength and jump performance, without increasing injury risk
(Impellizzeri et al., 2013)	Randomised controlled trial (parallel-group RCT)	Italy (amateur football clubs; Veneto & Trentino regions)	n = 81 male amateur soccer players; mean age = 23 years; non-elite competitive level	FIFA 11+ (full program; progressive levels 1–3)	Usual warm-up (running, stretching, technical drills, small-sided games)	3×/week for 9 weeks	Injury incidence not measured (mechanistic study)	Neuromuscular control (time-to-stabilisation), knee flexor/extensor strength (isokinetic), balance (SEBT), core stability, sprint, agility, vertical jump	FIFA 11+ improves neuromuscular control and dynamic stability in amateur soccer players; strength gains are small and primarily relevant for injury prevention rather than performance enhancement

Table 2. (Continued)

Author (Year)	Study Design	Country / Setting	Participants (n, age, sex, level)	Intervention (FIFA 11+ version)	Comparator	Frequency & Duration	Outcomes – Injury	Outcomes – Functional	Conclusion
Panchal et al. (2025)	Quasi-experimental, pre–post with comparison group	India; professional cycling academies	n = 80 male professional cyclists (final analysed 40/group); age 18–45 years; competitive level (state–national)	FIFA 11+ warm-up adapted for cyclists (3-part program: running, strength/balance, dynamic drills)	Conventional cycling warm-up	4 sessions/week, 20 min/session, 8 weeks	Clinical injury incidence (%) across body regions (thigh, knee, ankle, back, shoulder, elbow, others)	Agility (T-test), flexibility (V-sit), explosive power (broad jump), balance (APP-Coo test), core strength (plank), endurance (3 km cycling), RPE	FIFA 11+ warm-up adapted for cycling improved physical performance and reduced injury incidence more than conventional warm-up
Soussi et al. (2025)	Randomized controlled trial	Hungary / youth soccer academy	n = 30 male youth soccer players; age 13–14 years (U14–U15); competitive youth level	FIFA 11+ standard warm-up program	Regular warm-up (usual training)	2×/week for 10 weeks	No direct injury incidence measured; biomechanical injury risk factors assessed (DKV)	Dynamic knee valgus, squat depth, isometric knee strength (H/Q), lower limb power (CMJ), knee ROM, agility (T-test), dynamic balance (Y-Balance)	FIFA 11+ effectively improves knee stability and several lower-limb functional outcomes, potentially reducing injury risk in male youth soccer players

DISCUSSION

This systematic review examined the effects of the FIFA 11+ program on lower limb functional outcomes in athletes. Overall, the narrative synthesis suggests that the FIFA 11+ program may positively influence several aspects of lower limb function, although the magnitude and consistency of effects varied across outcomes and studies. The discussion below is organized according to the primary functional outcomes investigated.

Effects of the FIFA 11+ Program on Range of Motion (ROM)

Several included studies reported improvements in joint range of motion, particularly at the hip, knee, and ankle, following implementation of the FIFA 11+ program (Arsenis et al., 2020; Ayala et al., 2017; Brito et al., 2010; Soussi et al., 2025; Sumartiningsih et al., 2022). These findings suggest that the program's dynamic warm-up structure, which incorporates progressive mobility and controlled joint excursions, may contribute to enhanced flexibility and joint mobility.

The observed ROM improvements may be explained by the dynamic stretching and movement preparation elements of the FIFA 11+ program (Bizzini & Dvorak, 2015). Dynamic warm-up activities have been shown to increase muscle–tendon compliance and joint mobility without negatively affecting neuromuscular performance (Behm & Chaouachi, 2011). Over repeated training sessions, such activities may promote chronic adaptations in soft tissue extensibility and movement efficiency.

However, ROM-related findings were not entirely consistent across studies, likely due to heterogeneity in measurement techniques, such as passive versus weight-bearing assessments, and differences in joint-specific testing protocols. This variability limits direct comparisons and highlights the need for standardized ROM assessment methods in future FIFA 11+ research.

Effects of the FIFA 11+ Program on Knee Extension

Evidence regarding the effects of the FIFA 11+ program on knee extension outcomes was more limited compared with other functional measures. Where reported, improvements in knee extension strength or control were modest and varied across studies (Daneshjoo et al., 2012; Daneshjoo et al., 2013; Soussi et al., 2025). These mixed findings may reflect the fact that the FIFA 11+ program emphasizes neuromuscular control and movement quality rather than isolated quadriceps strengthening.

From a mechanistic perspective, improvements in knee extension-related function may be mediated through enhanced lower limb alignment, trunk stability, and neuromuscular coordination, rather than direct increases in maximal knee extensor strength. Previous research suggests that neuromuscular training can improve knee joint stability and force transmission efficiency even in the absence of large strength gains (Bahr & Krosshaug, 2005).The limited and heterogeneous reporting of knee extension outcomes underscores the need for clearer operational definitions and consistent testing approaches in future studies.

Effects of the FIFA 11+ Program on Hip Internal and External Rotation

Several studies included in this review examined hip internal and external rotation, reporting improvements following FIFA 11+ implementation (Impellizzeri et al., 2013; Zhou et al., 2022). Enhanced hip rotational mobility is particularly

relevant for sports involving cutting, pivoting, and directional changes, where hip joint mechanics play a crucial role in both performance and injury risk.

The FIFA 11+ program incorporates exercises targeting pelvic control, core stability, and multi-planar lower limb movements, which may indirectly influence hip rotational capacity (Impellizzeri et al., 2013; Zhou et al., 2022). Improved neuromuscular control around the hip joint may reduce excessive joint stiffness while promoting functional mobility (Mendiguchia & Brughelli, 2011).

Nevertheless, findings related to hip rotation were inconsistent across studies, likely due to differences in testing positions, examiner techniques, and participant characteristics. These inconsistencies further emphasize the importance of methodological standardization.

Effects of the FIFA 11+ Program on Hamstring Muscle Strength

Among all functional outcomes assessed, hamstring muscle strength demonstrated the most consistent improvements following FIFA 11+ training. Multiple studies reported post-intervention increases in hamstring strength, typically measured using isokinetic dynamometry, suggesting favorable neuromuscular adaptations (Arsenis et al., 2020; Brito et al., 2010; Bukry et al., 2024; Danesjhoo et el., 2013).

The improvements in hamstring strength can be attributed to the eccentric and neuromuscular loading components embedded within the FIFA 11+ program. Exercises emphasizing controlled deceleration, trunk stabilization, and posterior chain engagement are known to enhance hamstring activation and force-producing capacity (Pun, 2020). Such adaptations are particularly relevant given the role of hamstring strength in sprinting performance and injury prevention.

Despite these positive findings, variability in testing velocities, contraction modes, and reporting practices limited direct comparison across studies. Nonetheless, the overall pattern of evidence supports a beneficial effect of the FIFA 11+ program on hamstring muscle function.

Limitations of the study

A key strength of this review is its systematic and transparent methodology, guided by PRISMA 2020 and prospectively registered in PROSPERO. The review comprehensively synthesized evidence across multiple lower limb functional domains, providing a broad perspective on the functional effects of the FIFA 11+ program beyond injury incidence alone. The use of a structured quality assessment tool further enhanced the rigor of the synthesis.

Several limitations should also be acknowledged. First, the included studies exhibited moderate methodological quality, with common limitations related to group comparability, randomization procedures, and blinding. Second, substantial heterogeneity in study design, outcome definitions, and measurement protocols precluded quantitative meta-analysis. Third, most studies focused on short- to medium-term interventions, limiting insight into the long-term functional effects of the FIFA 11+ program. These limitations reflect gaps in the existing literature rather than shortcomings of the present review and highlight important directions for future research.

CONCLUSIONS

This systematic review synthesized the available evidence on the effects of the FIFA 11+ program on lower limb functional outcomes in athletes. Overall, the findings suggest that the FIFA 11+ program is associated with favorable adaptations in hamstring muscle strength and selected aspects of joint range of motion, while evidence related to knee extension and hip rotational outcomes remains variable. Although methodological heterogeneity across studies precluded quantitative meta-analysis, the consistency of positive trends supports the potential functional benefits of the FIFA 11+ program beyond injury prevention alone. Future research employing standardized outcome measures, robust experimental designs, and longer follow-up periods is warranted to clarify the magnitude of these effects and to strengthen the evidence base for integrating the FIFA 11+ program into performance-oriented training contexts.

DATA AVAILABILITY

All data extracted and synthesized in this review were obtained from published peer-reviewed studies indexed in Scopus and PubMed. The extracted data supporting this review's findings are available from the corresponding author upon reasonable request.

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CONFLICT OF INTEREST

The authors declare no conflict of interest

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