Ciencia Latina Revista Científica Multidisciplinar, Ciudad de México, México.
ISSN 2707-2207 / ISSN 2707-2215 (en línea), septiembre-octubre 2026,
Volumen 10, Número 5.

https://doi.org/10.37811/cl_rcm.v10i5

FIELD-BASED PHYSICAL AND FUNCTIONAL ASSESSMENT IN AMATEUR TEAM SPORT: ANTHROPOMETRY, PERFORMANCE, AND PREPARTICIPATION SCREENING AS A BASIS FOR INJURY PREVENTION AND TRAINING GUIDANCE. A SCOPING REVIEW

EVALUACIÓN FÍSICA Y FUNCIONAL EN EL TERRENO DE JUEGO EN DEPORTES DE EQUIPO AMATEUR: ANTROPOMETRÍA, RENDIMIENTO Y CRIBADO PREVIO A LA PARTICIPACIÓN COMO BASE PARA LA PREVENCIÓN DE LESIONES Y LA ORIENTACIÓN DEL ENTRENAMIENTO. UNA REVISIÓN EXPLORATORIA

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DOI: https://doi.org/10.37811/cl_rcm.v10i5.26407

Field-based Physical and Functional Assessment in Amateur Team Sport: Anthropometry, Performance, and Preparticipation Screening as a Basis for Injury Prevention and Training Guidance. A Scoping Review

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ABSTRACT
Amateur team sports impose repeated physical and neuromuscular demands on athletes who differ in age, sex, training history, playing position, competitive level, and exposure. Nevertheless, assessment in resource-limited settings is often fragmented, standardized inconsistently, or restricted to isolated indicators. This scoping review mapped evidence on field-based anthropometric, functional, performance, and preparticipation assessment in amateur and non-elite team-sport populations and examined how these domains are associated with physical performance, musculoskeletal injury history, and preventive decision-making. The review followed PRISMA-ScR and the Arksey and O'Malley framework. PubMed/MEDLINE was searched for publications from 2021 to July 2026 using a title-anchored strategy restricted to English, Spanish, and Chinese. Of 145 records identified, 119 were retained after title and abstract screening for full-text eligibility assessment; therefore, the synthesis remains provisional until full-text confirmation is completed. Evidence was organized into three components: anthropometry and body composition; functional and field performance; and preparticipation screening, injury epidemiology, and prevention. The emerging evidence indicates that body mass index has limited value as a standalone indicator and should be complemented by measures of central adiposity and body composition. Intermittent endurance, sprinting, change of direction, explosive performance, mobility, and balance represent related but nonredundant dimensions whose associations with body profile vary across sex, age, sport, position, and competitive level. Injury evidence supports multifactorial interpretation, systematic recording of previous injury, and multicomponent prevention, while cautioning against using any single test to predict injury. The review proposes an integrative framework and a resource-proportional assessment pathway prioritizing safety, standardization, measurement error, and contextual interpretation.

***Keywords*:** body composition; soccer; rugby; intermittent endurance; measurement error; athlete monitoring

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Evaluación Física y Funcional en el Terreno de Juego en Deportes de Equipo Amateur: Antropometría, Rendimiento y Cribado Previo a la Participación como base para la Prevención de Lesiones y la Orientación del Entrenamiento. Una Revisión Exploratoria

RESUMEN

Los deportes de equipo amateur imponen demandas físicas y neuromusculares repetidas sobre deportistas que difieren en edad, sexo, experiencia de entrenamiento, posición de juego, nivel competitivo y exposición. Sin embargo, la evaluación en contextos con recursos limitados suele encontrarse fragmentada, estandarizada de manera inconsistente o restringida an indicadores aislados. Esta revisión de alcance mapeó la evidencia sobre evaluación antropométrica, funcional, del rendimiento y preparticipativa realizada mediante procedimientos de campo en poblaciones amateur y no élite de deportes de equipo, y examinó cómo estos dominios se asocian con el rendimiento físico, los antecedentes de lesión musculoesquelética y la toma de decisiones preventivas. La revisión siguió PRISMA-ScR y el marco de Arksey y O'Malley. Se realizó una búsqueda en PubMed/MEDLINE de publicaciones comprendidas entre 2021 y julio de 2026, mediante una estrategia anclada en el título y restringida an inglés, español y chino. De los 145 registros identificados, 119 fueron retenidos después del cribado de título y resumen para la evaluación de elegibilidad a texto completo; por tanto, la síntesis permanece provisional hasta completar dicha confirmación. La evidencia se organizó en tres componentes: antropometría y composición corporal; evaluación funcional y rendimiento de campo; y tamizaje preparticipativo, epidemiología de lesiones y prevención. La evidencia emergente indica que el índice de masa corporal presenta un valor limitado como indicador aislado y debe complementarse con medidas de adiposidad central y composición corporal. La resistencia intermitente, la velocidad, el cambio de dirección, el rendimiento explosivo, la movilidad y el equilibrio representan dimensiones relacionadas, pero no redundantes, cuyas asociaciones con el perfil corporal varían según sexo, edad, deporte, posición y nivel competitivo. La evidencia sobre lesiones respalda una interpretación multifactorial, el registro sistemático de lesiones previas y la prevención multicomponente, al tiempo que desaconseja utilizar una sola prueba para predecir lesiones. La revisión propone un marco integrador y una ruta de evaluación proporcional a los recursos que prioriza la seguridad, la estandarización, el error de medición y la interpretación contextual.

***Palabras clave*:** composición corporal; fútbol; rugby; resistencia intermitente; error de medición; seguimiento del deportista

Artículo recibido 20 agosto 2026
Aceptado para publicación: 20 setiembre 2026

INTRODUCTION

Amateur team sport is a regulated competitive practice that, despite its non-professional status, imposes real and repeated physical demands on a highly heterogeneous population differing in age, training experience, playing position, and exposure (Hernandez-Martinez et al., 2024). In these settings, decisions about participation, selection, and training load are frequently grounded in observation and physical appearance rather than in objective measurement, and structured, systematized assessment remains rare (Asimakidis et al., 2024). The gap is not trivial. Amateur athletes sustain musculoskeletal injuries at rates that are far from negligible (Sonesson et al., 2023), and even lower-contact modalities such as flag football report meaningful injury burdens (Balachandran et al., 2025; Barber Foss et al., 2023). The scarcity of feasible, reproducible field assessment therefore constrains both the individualization of training and the early identification of athletes who might benefit from preventive attention.

A first obstacle to sound assessment is the widespread reliance on body mass index as a proxy for physical condition. Body mass index is an accessible mass-for-stature ratio, but it cannot distinguish fat mass from fat-free mass or describe how tissue is distributed, and its conventional cut-off points perform poorly in athletic populations (Milanese et al., 2025). The body-composition methods that do capture these dimensions are not interchangeable, since each carries distinct assumptions, sources of error, and dependence on technician standardization (Campa et al., 2021; Kasper et al., 2021). A defensible body reading in sport is therefore multidimensional, complementing body mass index with indicators of central adiposity and with estimates of body composition rather than treating a single value as sufficient (Ben Brahim et al., 2023).

The relationship between body profile and physical performance is, moreover, neither linear nor uniform. Higher adiposity tends to accompany poorer sprint and change-of-direction times, whereas greater fat-free mass tends to accompany jumping and power output, but the magnitude and even the direction of these associations vary with age, sex, playing position, and the specific quality assessed (Bustamante-Garrido et al., 2024; Ishida et al., 2021; Leão et al., 2022). Evidence in female and semi-professional cohorts shows that anthropometric profiles differ by position and sex, which cautions against adopting a single normative reference (Hernandez-Martinez et al., 2024; Ramírez-Munera et al.,

2025; Toro-Román et al., 2023). These patterns are associated: they describe how body characteristics and performance co-vary, not how one produces the other, a distinction that governs the interpretation offered throughout this review.

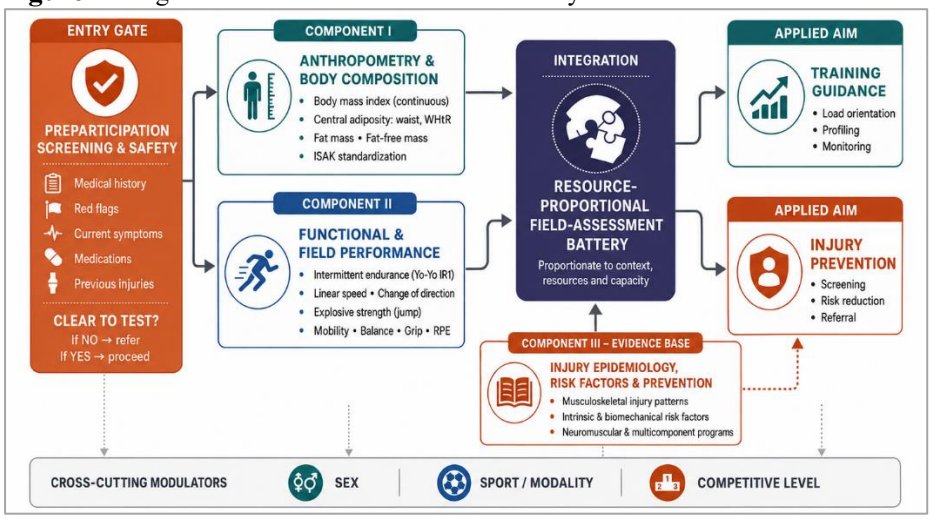
Assessment matters not only for describing athletes but also for protecting them. Exercise-based neuromuscular and multicomponent programs can reduce non-contact musculoskeletal injuries in football and related team sports, yet their benefit depends on adequate adherence and, logically, on a prior diagnostic phase that identifies whom and what to target (Bullock et al., 2025; Lemes et al., 2021; Mandorino et al., 2023). Body composition and field fitness have, in turn, been combined to model injury risk in footballers, an empirical bridge that links the performance axis to the injury axis and shows that description and prevention are continuous rather than separate concerns (Martins et al., 2022).

Before any effortful test is administered, a basic preparticipation appraisal of health status, symptoms, and medical and injury history is warranted. This screening is preventive, proportionate, and explicitly non-diagnostic; its purpose is to decide whether to proceed, adapt, postpone, or refer, not to certify fitness (Weise et al., 2025). Much of the available guidance rests on consensus rather than on trial evidence, yet the ethical and methodological function of this gate is clear: it is what makes the remainder of field assessment defensible (Harmon et al., 2013).

Two formative research protocols motivated the present review, one concerned with anthropometry and performance in amateur football and the other with preparticipation conditioning, functional evaluation, and injury history in amateur flag football. Rather than juxtaposing them, we raise the object of study to a common level: the system of field-based physical and functional assessment in amateur team sport, of which football and flag football are two applications of the same underlying problem, namely, how to evaluate an amateur athlete safely, feasibly, and reproducibly in the absence of laboratory resources, and what such measurements inform. Accordingly, this scoping review asks what recent evidence (2021 to 2026) supports field-based anthropometric, functional, and preparticipation assessment in amateur team-sport athletes, and how these indicators relate to physical performance and to musculoskeletal injury history and risk.

Four subquestions structure the synthesis, addressing (a) anthropometry and body composition, (b) functional and field performance, (c) preparticipation screening and injury, and (d) the integration of these components and their modulation by sex, sport, and competitive level. The review advances three contributions: an integrative conceptual framework of field assessment in amateur team sport, presented in Figure 1; a resource-proportional field-assessment battery transferable across team modalities; and a critical synthesis of the direction and heterogeneity of the anthropometry, performance, and injury relationships, with sex, sport, and level treated as an explicit analytic axis rather than a peripheral caveat.

Figure 1 Integrative Framework for Field-Based Physical and Functional Assessment in Amateur Team Sport



Note. The framework positions Component III (preparticipation screening and safety) as the entry gate to assessment and, separately, as the evidence base for injury epidemiology, risk factors, and prevention. Component I (anthropometry and body composition) and Component II (functional and field performance) function as descriptors that feed a resource-proportional field-assessment battery, which in turn informs two applied aims: training guidance and injury prevention. Sex, sport or modality, and competitive level operate as cross-cutting modulators (Objective 4). The guiding principle is association rather than causation, together with standardization and control of measurement error. Own elaboration.

METHOD

Protocol, design, and reporting

This study was designed as a scoping review, an approach suited to mapping a broad and heterogeneous body of evidence and to clarifying concepts and gaps rather than answering a narrow effect question. The review was conducted and is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR; Tricco et al., 2018) and was structured following the methodological stages proposed by Arksey and O'Malley (2005) and refined by Levac et al. (2010): identifying the review question, identifying relevant records, selecting sources, charting the data, and collating and summarizing the results. Because most of the primary studies anticipated in this field are observational, their reporting was appraised with the

Strengthening the Reporting of Observational Studies in Epidemiology statement in mind (von Elm et al., 2007). No meta-analysis was planned, given the expected heterogeneity of sports, sexes, competitive levels, and outcomes.

Information sources and search strategy

Records were identified in a single bibliographic database, PubMed/MEDLINE. The use of one database is an explicit boundary of the review's scope and is acknowledged as a limitation; a fully exhaustive map would additionally interrogate Scopus, Web of Science, SPORTDiscus, SciELO, and Dialnet. The last search was executed on July 15, 2026.

The search used a title-anchored Boolean strategy composed of three concept blocks combined with the AND operator: (a) team sport (soccer, football, rugby, futsal, or flag football), (b) competitive level (amateur, recreational, semi-professional, sub-elite, university, or collegiate), and (c) the object of assessment (body composition, anthropometry, injury, or fitness). Anchoring all three blocks in the title field prioritized precision, so that sport, level, and object of study were simultaneously present in the record title. The search was restricted by language to English, Spanish, and Chinese, and by publication date to the period 2021 through 2026. The complete search string, field tags, filters, and eligibility parameters are reported in Table 1. Indispensable methodological classics outside the temporal window were admitted when justified, specifically the Yo-Yo intermittent recovery test protocol (Bangsbo et al., 2008) and the rating of perceived exertion scale (Borg, 1998).

Table 1 Search Strategy and Eligibility Parameters for the Scoping Review

Parameter	Specification
Design and reporting	Scoping review following PRISMA-ScR (Tricco et al., 2018); methodological stages per Arksey and O'Malley (2005) and Levac et al. (2010).
Source and coverage	PubMed/MEDLINE only; single-database search treated as an explicit scope boundary. Last search: July 15, 2026.
Period and languages	January 2021 to July 15, 2026; English, Spanish, or Chinese.
Search design	Three title-anchored concept blocks combined with AND (synonyms within each block with OR); every block required in the record title. Block 1 (team sport): soccer, football, rugby, futsal, flag football. Block 2 (level): amateur, recreational, semi-professional, sub-elite, university, collegiate. Block 3 (assessment object): body composition, anthropometr*, injur*, fitness.

Parameter	Specification
Boolean string	(("soccer"[Title] OR "football"[Title] OR "rugby"[Title] OR "futsal"[Title] OR "flag football"[Title]) AND ("amateur"[Title] OR "recreational"[Title] OR "semi-professional"[Title] OR "sub-elite"[Title] OR "university"[Title] OR "collegiate"[Title]) AND ("body composition"[Title] OR anthropometr*[Title] OR injur*[Title] OR fitness [Title]))
Eligible population	Team-sport athletes (soccer or football, flag football, rugby, futsal) at amateur, recreational, university, collegiate, semi-professional, or sub-elite levels, including mixed samples containing at least one eligible level.
Eligible components and sources	At least one component: (a) anthropometry and body composition, (b) functional and field performance, or (c) preparticipation screening, injury, and prevention. Source types: primary studies, systematic or scoping reviews, and consensus or position documents.
Exclusion criteria	E1, wrong population; E2, outside the review axes; E3, ineligible publication type (editorial, protocol without results, erratum, or abstract without analyzable data); E4, wrong outcome (surgical treatment, postoperative rehabilitation, or diagnostic imaging without field application); E5, non-retrievable source; E6, sport outside scope.
Screening	Title and abstract screening against a fixed rubric via an artificial-intelligence-assisted procedure tuned for sensitivity; full-text confirmation pending.
Yield	145 records identified and screened; no duplicates removed (single database); 119 provisionally retained pending full-text confirmation.

Note. PRISMA-ScR = Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews. The asterisk denotes truncation (e.g., anthropometr* retrieves anthropometry and anthropometric; injur* retrieves injury and injuries); the [Title] tag restricts each term to the record title. Methodological classics outside the temporal window (the Yo-Yo intermittent recovery test protocol and the Borg rating of perceived exertion scale) support instrument interpretation and are not part of the contemporary evidence count.

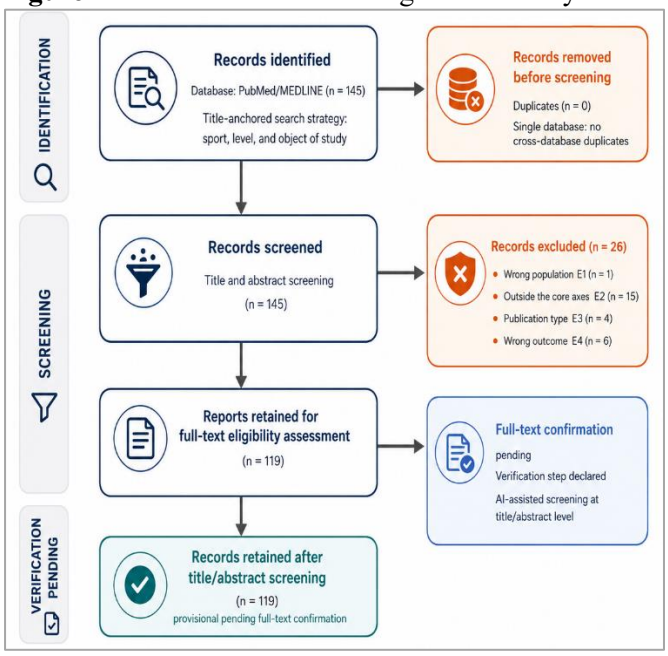
Eligibility criteria and study selection

Sources were eligible when they met all of the following criteria: a team-sport population (soccer or football, flag football, rugby, or futsal) at an amateur, recreational, university, collegiate, semi-professional, or sub-elite level, or a mixed sample including such athletes; assessment of at least one of the three review components (anthropometry and body composition; functional and field performance; or preparticipation, injury, and prevention); a primary study, review, or consensus document; publication in English, Spanish, or Chinese; and publication between 2021 and 2026. Six predefined exclusion categories were applied: wrong population (E1); topic outside the review axes (E2); publication type without primary data, such as editorials, study protocols, or errata (E3); wrong outcome, such as surgical management or diagnostic imaging (E4); non-retrievable records (E5); and sport outside the review scope (E6).

Title and abstract screening were performed autonomously by a large language model applied against the fixed eligibility rubric described above. This procedure is declared transparently as artificial-intelligence-assisted screening; recent evidence indicates that such models can screen records against

explicit criteria with useful accuracy, while their performance depends on how precisely the criteria are formulated and warrants human verification (Khraisha et al., 2024; Oami et al., 2024). Screening was tuned to favor sensitivity. Intra-screener stability was estimated by re-adjudicating a reproducible random subsample of 25 records (seed = 42), blind to the first pass, which yielded 96.0% agreement (Cohen's kappa = 0.834). Because identification drew on a single database, no duplicate records required removal. Of 145 records identified and screened, 26 were excluded (wrong population, n = 1; outside the review axes, n = 15; publication type, n = 4; wrong outcome, n = 6), leaving 119 sources provisionally included. Confirmation of these provisionally included records at the full-text level is declared as a pending verification step rather than a completed stage. The selection process and the corresponding counts are shown in Figure 2.

Figure 2 PRISMA-ScR Flow Diagram for Study Selection



Note. The diagram follows the flow of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (Tricco et al., 2018). Identification was limited to a single database (PubMed/MEDLINE), declared as a scope boundary; therefore, no duplicate records were removed. Title and abstract screening were artificial-intelligence-assisted and tuned for sensitivity, with intra-screener stability of 96.0% (Cohen's kappa = 0.834) on a reproducible random subsample of 25 records (seed = 42). The 119 sources are provisional inclusions; full-text confirmation constitutes the pending verification step. E1 through E4 denote the predefined exclusion reasons applied at screening.

Data charting and synthesis

Data were charted into an evidence matrix capturing, for each source, the author and year, country and context, study design, sport and sex, sample, variables, instruments, main findings, and limitations (Table 2). The synthesis was narrative and thematic, organized by the three review components, with each component addressing one subquestion.

Consistent with the scoping design and the heterogeneity of the corpus, no statistical pooling was undertaken; associations are reported in terms of direction and, where available, magnitude, and are interpreted as associative rather than causal.

RESULTS

The 119 provisionally included sources were organized into the three review components. Their provisional characteristics are summarized in Table 2. This section presents the synthesis of Component I; Components II and III follow. Throughout, relationships are described as associations, and their direction and heterogeneity are emphasized rather than any single summary estimate.

Table 2 Provisional Characteristics of Sources Extracted for the Narrative Synthesis

Study	Setting and sample	Design	Contribution [role]
Milanese et al. (2025)	Italy; 622 male athletes	Cross-sectional, multivariable	BMI classes vs. DXA adiposity; supports cautious BMI thresholds [IT]
Campa et al. (2021)	International; mixed athletes	Narrative review	DXA, BIA, BIVA, skinfolds not interchangeable [SS]
Kasper et al. (2021)	International; applied sport	Narrative review	Applied utility of methods; skinfolds defensible if standardized [SS]
Mathisen et al. (2023)	International; sport populations	Critical review/consensus	Best-practice, ethical, non-stigmatizing assessment [SG]
Ben Brahim et al. (2023)	Pending; young adult men	Cross-sectional	BMI vs. RPI vs. WHtR and fitness; nonlinear [IT]
Samarein et al. (2023)	Iran; 270 referees	Cross-sectional, correlational	Waist, WHtR, %fat, body-shape indices as complementary [IT]
İlhan et al. (2023)	Türkiye; 120 male referees	Cross-sectional, correlational	Body composition with sprint and field endurance [IT]
Petri et al. (2024a)	International; elite M/F soccer	Normative cross-sectional	Sex/position ISAK references; limits of elite norms [IT]
Petri et al. (2024b)	Italy; 88 elite (44 W, 44 M)	Longitudinal observational	Anthropometry/BIA change during a nutrition program [IT]
Toro-Román et al. (2023)	Spain; 50 semipro (26 M, 24 W)	Comparative cross-sectional	Anthropometry/fitness differ by sex and position [TA]
Spehnjak et al. (2021)	SE Europe; 394 U15–senior	Comparative cross-sectional	Body mass/composition across age and category [IT]
Portella et al. (2023)	Brazil; 206 M, 11–16 y	Descriptive-correlational	Maturation's contribution to composition/fitness [IT]
Santos-Sánchez et al. (2021)	Spain; 71 M U12	Cross-sectional	Body composition by position and diet [IT]
Staśkiewicz et al. (2022)	Poland; professional	Longitudinal observational	Composition over macrocycle; stable BMI hides fat/FFM shifts [IT]
Staśkiewicz et al. (2023)	Poland; 38 professional	Longitudinal observational	Age-related composition and nutrition awareness [IT]
Macuh et al. (2023)	Slovenia; 23 professional (15 tested)	Cross-sectional observational	Diet, composition, performance; no causality [IT]

Study	Setting and sample	Design	Contribution [role]
Talavera-Hernández et al. (2025)	Pending; elite flag football	Cross-sectional normative	Kinanthropometric profile; modality-specific transfer [IT]
Asimakidis et al. (2024)	24 countries; 102 practitioners	Cross-sectional survey	Test-selection practice, barriers, little error use [IT]
Asimakidis et al. (2025)	International; elite male soccer	Systematic review	Heterogeneity in aerobic/RSA testing protocols [SS]
Zemková & Pacholek (2023)	Pending	Repeated-measures	Learning effect across repeated Yo-Yo tests [IT]
Ishida et al. (2021)	USA; 23 M intercollegiate	Cross-sectional, correlational	Composition/strength/power with sprint, jump, endurance [TA]
Leão et al. (2022)	Portugal; 66 M youth	Descriptive-correlational	Composition with jump, strength, intermittent endurance [IT]
Bustamante-Garrido et al. (2024)	Chile; 58 M cadets	Cross-sectional, regression	Anthropometric/mechanical contribution to sprint by distance [IT]
França et al. (2024)	Portugal (Madeira); 96 youth	Cross-sectional, correlational	Composition, power, speed, agility interrelated [IT]
Ciocca et al. (2022)	Pending	Repeated-trial, fatigue	COD distinct from agility under fatigue [IT]
Morral-Yepes et al. (2023)	Pending	Methodological, correlational	COD speed vs. reactive agility distinction [IT]
Gisladottir et al. (2024)	Europe; 78 U14, 43 senior	Cross-sectional, correlational	Shared/nonredundant traits of agility, sprint, jump [IT]
Becerra-Patiño et al. (2025)	Colombia; youth	Cross-sectional, PCA	Multidimensional fitness profiles by playing role [IT]
Ramírez-Munera et al. (2025)	Spain; 34 professional women	Cross-sectional, correlational	Preseason anthropometry with performance [IT]
Hernandez-Martinez et al. (2024)	Chile; 160 amateur women	Comparative cross-sectional	Composition/performance by position, amateur women [TA]
Li et al. (2025)	China; male university students	RCT	8-wk functional training; movement quality/fitness [TA]
Weise et al. (2025)	International; 35 documents, 305 recs	Systematic review of guidelines	History, screening, risk-based testing, referral [SG]
Balachandran et al. (2025)	USA; women flag football	10-yr epidemiological review	Injured regions and types, female flag football [AP]
Barber Foss et al. (2023)	USA; youth flag football	Descriptive epidemiology	Game-related injury patterns, youth flag football [IT]
Mao et al. (2025)	USA; female American football	Age-stratified epidemiology	Injury patterns by age, 2015–2024 [IT]
Prieto-González et al. (2021)	Spain; adolescent athletes	Injury surveillance	Injury occurrence and candidate factors [IT]
Sonesson et al. (2023)	Sweden; amateur M/F soccer	Prospective cohort	Age and baseline injury as risk indicators [TA]
Yeomans et al. (2021)	Ireland; amateur M/F rugby	Comparative epidemiology	Injury patterns by sex, amateur rugby [TA]
Marrese et al. (2025)	Brazil; rugby union	Epidemiological	Incidence, severity, mechanism, region [AP]

Study	Setting and sample	Design	Contribution [role]
Yendluri et al. (2024)	USA; M/F rugby	Epidemiological trend	Sex-specific rugby injury trends 2008–2022 [IT]
Bellingan et al. (2025)	International; women's rugby	Scoping review	Epidemiology, candidate risks, gaps in women's rugby [SS]
Chia et al. (2022)	International; team-ball sports	SR + meta-analysis	Noncontact ACL by sex, age, sport, level, exposure [SS]
Collings et al. (2022)	Australia; elite women footballers	Prospective observational	Strength/biomechanics as ACL-related indicators [IT]
Achenbach et al. (2024)	Germany; professional women	Observational	Movement/situational ACL injury patterns [IT]
Mancino et al. (2024)	UK; female athletes	Narrative review	Sex-related ACL risks and prevention [SS]
John et al. (2025)	International; women's football	Review	Sex-specific injury and prevention [SS]
Liveris et al. (2025)	Pending; male football	Structural equation modeling	Interdependent intrinsic factors, lower-limb injury [AP]
Mandorino et al. (2023)	International; youth soccer	Systematic review	Injury incidence and candidate factors [SS]
Martins et al. (2022)	Portugal; elite football	Predictive modeling	Composition/fitness in injury-prediction models [IT]
Lemes et al. (2021)	International; 13,355 athletes	SR + meta-analysis	Exercise-based prevention of noncontact injury [SS]
Bullock et al. (2025)	International; female athletes	SR + consensus framework	Lower-extremity prevention; adherence matters [SS]
Liu et al. (2026)	International; ages 10–19	SR + meta-analysis	Multicomponent prevention in adolescent team sport [SS]
Jaskulski et al. (2025)	Poland; women's rugby	Intervention	8-Wk sensorimotor program; neuromuscular outcomes [AP]
Cardoso-Marinho et al. (2022)	International; football	Systematic review	Athletes' injury-risk perception and behavior [SS]

Note. Role codes: TA = target-aligned primary evidence (amateur, collegiate, university, or semiprofessional contexts within scope); IT = indirect-transfer primary evidence (elite, professional, youth, or referee populations, informative but not directly representative of amateur adults); SS = secondary synthesis (systematic, scoping, or narrative review); SG = secondary guidance (consensus or guideline synthesis); AP = alignment pending. "Pending" in setting denotes country, sample, or level to be verified from the full text before publication. M = men; W = women; RPI = reciprocal ponderal index; WHtR = waist-to-height ratio; BMI = body mass index; BIA = bioelectrical impedance analysis; BIVA = bioelectrical impedance vector analysis; DXA = dual-energy X-ray absorptiometry; FFM = fat-free mass; ISAK = International Society for the Advancement of Kinanthropometry; RSA = repeated-sprint ability; COD = change of direction; PCA = principal component analysis; RCT = randomized controlled trial; SR = systematic review; ACL = anterior cruciate ligament.

Component I. Anthropometry and body composition

This component addresses the first subquestion, concerning what anthropometric and body-composition indicators contribute, and what they fail to capture, when describing the amateur team-sport athlete. The synthesis moves from the single most common indicator to the multidimensional profile that the evidence supports, and the indicators and methods are summarized in Table 3.

Body mass index: usefulness and limits in athletic populations

Body mass index remained the most accessible anthropometric indicator in amateur settings, yet the corpus consistently framed it as a measure of relative mass rather than of adiposity or its distribution. Analyses in athletes indicated that conventional overweight and obesity cut-off points misclassify muscular individuals and require revision or external validation before being applied to sporting populations (Milanese et al., 2025). When body mass index was examined alongside complementary indices, its association with fitness was weaker and less specific than that of measures incorporating stature and fat distribution (Ben Brahim et al., 2023). Longitudinal observation across a competitive macrocycle further showed that body mass index can remain stable while body composition shifts, so that a single ratio may conceal meaningful compensatory changes in fat and fat-free mass (Staśkiewicz et al., 2022). The evidence therefore supported treating body mass index as a continuous, context-dependent descriptor rather than as a classificatory threshold.

Body composition: components and estimation methods

Body composition was most often described through a two-compartment logic separating fat mass from fat-free mass, with the important caveat that fat-free mass is not equivalent to muscle mass. The reviewed methods, including skinfolds, bioelectrical impedance and vector analysis, and dual-energy X-ray absorptiometry, were not interchangeable, since each rest on distinct assumptions and is sensitive to hydration status, the prediction equation, and technician standardization (Campa et al., 2021). No single method emerged as universally superior; the applied literature argued that the appropriate choice depends on the assessment purpose, the available resources, and the capacity to standardize procedures, and it reappraised accessible field methods such as skinfolds as defensible when performed rigorously (Kasper et al., 2021). Best-practice guidance emphasized that body-composition data should be collected and interpreted to minimize health and performance risks and to avoid over-interpreting slight changes (Mathisen et al., 2023).

Central adiposity: waist circumference and waist-to-height ratio

Indicators of central adiposity captured a dimension that body mass index does not, namely the distribution of tissue. Waist circumference and the waist-to-height ratio were associated with fitness in young adults in ways not fully reflected by body mass index alone, which supported their inclusion as

complementary descriptors (Ben Brahim et al., 2023). In officiating and playing populations, anthropometric indices differed by competitive division and related to performance, although these associations were sensitive to the anatomical measurement site and to standardization of the protocol (İlhan et al., 2023; Samarein et al., 2023). The evidence thus positioned central adiposity as an informative, low-cost addition to the field profile rather than as a redundant measure.

ISAK standardization and modulation by sex and playing position.

Comparability across athletes and studies depended on standardized measurement, and the corpus repeatedly invoked the procedures of the International Society for the Advancement of Kinanthropometry as the reference for consistent data collection, including the derivation of sex-specific and position-specific reference values (Petri et al., 2024a). Anthropometry, body composition, and fitness differed between sexes and playing positions in semi-professional players, which cautioned against applying a single normative profile across roles (Toro-Román et al., 2023). The same logic extended to flag football, where a proposed kinanthropometric profile for elite athletes offered a body reference that helps contextualize the modality and bridges the anthropometric component to the performance and injury axes (Talavera-Hernández et al., 2025). Because these profiles varied systematically with sex, sport, and position, they are read here as modulated associations rather than fixed standards, a point developed visually in Figure 3 and revisited in the Discussion.

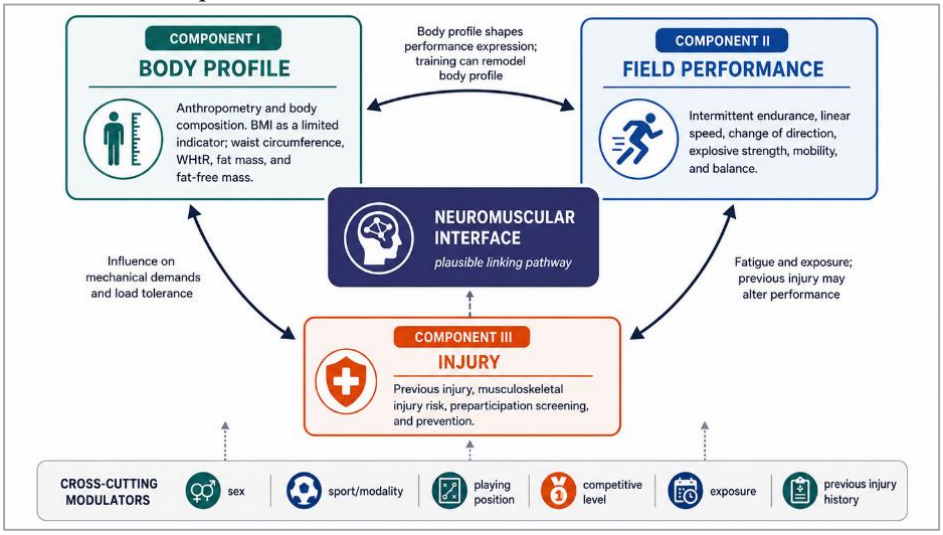
Table 3 Anthropometric and Body-Composition Indicators and Measurement Methods

Indicator	Definition / output	Standardization and key caution	Sources
Body mass	Total, mass (kg)	Calibrated scale, light clothing, standard time of day; varies with hydration and intake; no tissue compartments	Petri et al. (2024a)
Stature	Height to vertex (cm)	Stadiometer, Frankfort plane, no footwear; small diurnal variation	Petri et al. (2024a)
Body mass index	Mass / height² (kg/m²)	From standardized mass and stature, ignores fat, FFM, and distribution; cutoffs misclassify athletes; read as continuous	Ben Brahim et al. (2023); Milanese et al. (2025); Staśkiewicz et al. (2022)
Waist circumference	Abdominal perimeter (cm)	Nonelastic tape at a fixed site, end-expiration; site-, tension-, and technique-sensitive; sites not interchangeable	Samarein et al. (2023)
Waist-to-height ratio	Waist / stature (same unit)	From standardized waist and stature; error transfers to the ratio; associations may be nonlinear	Ben Brahim et al. (2023); Samarein et al. (2023)

Indicator	Definition / output	Standardization and key caution	Sources
Sum of skinfolds	Sum of skinfold thicknesses (mm)	Calibrated caliper, fixed sites, side, and sequence; assessor- and TEM-dependent; keep the protocol constant	Campa et al. (2021); Kasper et al. (2021)
Body-fat percentage	Estimated % fat mass	From a skinfold equation, BIA, or DXA; method-, equation-, and device-dependent; not interchangeable	Campa et al. (2021); Kasper et al. (2021); Milanese et al. (2025)
Fat mass	Estimated fat compartment (kg)	Derived from % fat or system output; estimated and model-sensitive	Campa et al. (2021); Kasper et al. (2021)
Fat-free mass	Estimated nonfat mass (kg)	From skinfolds, BIA, BIVA, or DXA; not equal to skeletal muscle mass; affected by hydration, glycogen, and algorithm	Campa et al. (2021); Kasper et al. (2021)
ISAK-standardized anthropometry	Standardized landmarks, masses, circumferences, breadths, skinfolds	Trained anthropometrist, standard sites, sequence, and repeats; report TEM; elite norms are not amateur standards; consider sex, age, position, level	Petri et al. (2024a)
Skinfold-caliper assessment	Skinfolds, sums, equation-derived estimates	Calibrated caliper, standard landmarking, consistent assessor, side, and timing; equation- and population-dependent; quantify TEM	Campa et al. (2021); Kasper et al. (2021)
Bioelectrical impedance analysis (BIA)	Compartments from tissue impedance via device equations	Constant device, electrodes, posture, hydration, and intake; devices and equations not interchangeable	Campa et al. (2021)
Bioelectrical impedance vector analysis (BIVA)	Resistance and reactance as a stature-normalized vector	Standard electrodes and posture; needs a population reference ellipse; the vector is not a direct muscle or fat mass	Campa et al. (2021)
Dual-energy X-ray absorptiometry (DXA)	Fat, lean soft tissue, and bone (regional and whole-body)	Standard scanner, calibration, positioning, and software; high reproducibility but costly, model-dependent, low radiation	Kasper et al. (2021); Milanese et al. (2025)

Note. FFM = fat-free mass; TEM = technical error of measurement; BIA = bioelectrical impedance analysis; BIVA = bioelectrical impedance vector analysis; DXA = dual-energy X-ray absorptiometry; ISAK = International Society for the Advancement of Kinanthropometry. Method selection should follow the assessment purpose, available resources, operator competence, expected measurement error, and capacity to reproduce standardized conditions; methods and equations are not interchangeable. Longitudinal assessments should retain the same device, equation, sites, assessor, sequence, and premeasurement conditions, and should report TEM when feasible. Results are descriptive or estimative, not a clinical diagnosis, and should be communicated confidentially and without stigmatizing language (Campa et al., 2021; Kasper et al., 2021; Mathisen et al., 2023).

Figure 3 Conceptual Model of Relationships Among Body Profile, Field Performance, and Injury in Amateur Team Sport



Note. The model depicts associative, bidirectional relationships among the three assessment components; it does not posit a linear causal chain. Neuromuscular control is represented as a mediating pathway linking body profile, performance, and injury. Double-headed arrows denote reciprocal association, not causal direction. Sex, sport and modality, playing position, competitive level, exposure, and previous injury history operate as cross-cutting modulators (Objective 4). Own elaboration.

Functional and field performance

This component addresses the second subquestion, concerning which functional and field-performance tests are valid, feasible, and safe in the amateur setting, and how they relate to the body profile. The synthesis proceeds from the logic of battery selection to each performance quality and closes with the notion of performance as a multidimensional profile; the tests, their outcomes, and their standardization requirements are summarized in Table 4.

Selecting the battery: validity, reliability, feasibility, and non-redundancy.

Survey evidence on applied testing practice indicated that the choice of tests is driven as much by feasibility, available time, the competitive calendar, and resources as by measurement properties, and that the measurement error attached to each test is seldom addressed explicitly in practice (Asimakidis et al., 2024). A systematic appraisal of aerobic-fitness and repeated-sprint protocols documented substantial variability in how ostensibly similar tests are administered, which limits comparability across studies and settings and underscores the need for explicit standardization of warm-up, familiarization, number of trials, recovery, test order, timing method, and surface (Asimakidis et al., 2025).

Intermittent endurance

Because team play is intermittent rather than continuous, field tests that reproduce repeated high-intensity efforts were favored, with the Yo-Yo intermittent recovery test as the reference instrument (Bangsbo et al., 2008). A structured compendium of Yo-Yo results confirmed the test's usefulness while cautioning that reference values vary markedly by version, sex, age, and competitive level, so that the distance covered is best treated as a direct field outcome rather than converted into an estimate of maximal oxygen uptake (Schmitz et al., 2018). Performance on the test was also shown to improve with repeated administrations, which makes familiarization a prerequisite for valid interpretation (Zemková & Pacholek, 2023). Intermittent endurance co-varied with body composition and with strength and power characteristics in collegiate and youth players, although the associations were of moderate and variable magnitude (Ishida et al., 2021; Leão et al., 2022).

Linear speed and change-of-direction speed

The corpus distinguished acceleration, maximal velocity, the ability to repeat sprints, and change-of-direction speed, and it insisted on the conceptual separation between preplanned change of direction and reactive agility, which involve different perceptual and coordinative demands (Ciocca et al., 2022; Morral-Yepes et al., 2023). Sprint performance was associated with anthropometric and mechanical factors, and these associations differed by distance, reflecting the distinct contributions of the acceleration and maximal-velocity phases (Bustamante-Garrido et al., 2024). Lower-body power, body composition, speed, and agility were interrelated in youth players, but no single measure accounted for the others, which supports assessing speed and change of direction as related yet non-redundant qualities (França et al., 2024).

Lower-limb explosive strength

Vertical and horizontal jumps served as accessible field indicators of lower-limb explosive strength rather than as pure measures of mechanical power. Jump performance was associated with fat-free mass and with relative strength, and it varied with playing role and developmental stage, so that it is most informative as one element of a broader profile (Becerra-Patiño et al., 2025; França et al., 2024; Ishida et al., 2021; Leão et al., 2022).

Mobility, balance, neuromuscular control, and movement quality

Beyond the classic performance qualities, the corpus extended the battery toward the functional and preventive domain, incorporating mobility, static and dynamic balance, neuromuscular control, and movement quality, which are particularly relevant in modalities that involve acceleration, deceleration, and pivoting. A randomized controlled trial in university students showed that a functional training program improved movement quality and physical fitness, indicating that these qualities are both assessable and modifiable (Li et al., 2025). Postural control differed across collision, contact, and non-contact sport athletes, which suggests that balance and control profiles are shaped by the demands of the modality (Schleich, 2017). Strength and biomechanical characteristics were, in turn, linked to knee-loading patterns in female footballers, connecting neuromuscular assessment to the injury component treated in Section 3.3 (Collings et al., 2022).

Internal load and perceived exertion

Ratings of perceived exertion were used as a complement to internal-load monitoring rather than as a substitute for test outcomes, and their interpretation was treated cautiously, since perceived effort reflects but does not replace the objective result of a performance test (Borg, 1998).

Performance as a multidimensional profile

Taken together, the evidence indicated that no isolated test represents performance. Fitness profiles derived through principal component analysis differed by playing role in youth players, which discourages ranking athletes on any single measure and favors role- and stage-specific interpretation (Becerra-Patiño et al., 2025). The heterogeneity of test protocols documented across the literature reinforces the same conclusion, since comparisons are only meaningful when administration is standardized (Asimakidis et al., 2025). The direction of these performance associations, and their integration with the body profile and the injury component, are represented in Figure 3.

Table 4 Functional and Field-Performance Tests Applicable to Amateur Team Sport

Test (construct)	Field protocol (brief)	Outcome (unit); reading; tier	Standardization, safety, and sequencing (key)	Sources
Yo-Yo IR1 (intermittent high-intensity endurance)	Repeated 2 × 20-m shuttles, audio-paced, 10-s active recovery, to exhaustion	Distance (m); more = better; Tier 1	Familiarize; keep audio, surface, footwear, turn, recovery, environment, and stop criteria constant; norms by version, sex, age, level; do not replace distance with estimated VO_2max; run late; stop for chest pain, dyspnea, dizziness, ataxia	Asimakidis et al. (2025); Bangsbo et al. (2008); Schmitz et al. (2018); Zemková & Pacholek (2023)
30-15 IFT (intermittent capacity, peak velocity)	30-s shuttle stages, increasing speed, 15-s recovery, standard audio, and course	Final velocity ($km \cdot h^{-1}$); higher = better; Tier 1	Constant course, audio, turn, recovery, stop; familiarize; not interchangeable with Yo-Yo IR1; run at end; same interruption criteria	Asimakidis et al. (2025)
10- or 20-m linear sprint (acceleration, speed)	Standard start behind line; 2–3 maximal trials, full recovery, best trial; gates at set distances	Time (s); shorter = better; Tier 1 (stopwatch) / Tier 2 (gates)	Constant start, distance, instructions, trials, recovery, surface, footwear, timing; prefer gates; do not pool manual and electronic times; after warm-up, before endurance; clear deceleration zone	Bustamante-Garrido et al. (2024); França et al. (2024)
Preplanned change-of-direction test (decelerate, reorient, accelerate)	Fixed course (505, modified T, or Illinois); familiarize; ≥2 valid trials, best time	Time (s); shorter = better; Tier 1 (stopwatch) / Tier 2 (gates)	Identify the protocol (courses not interchangeable); standard cone spacing, entry, side, trials, timing; invalidate missed cones or slips; nonslip surface; stop for pain or instability	Ciocca et al. (2022); Gisladottir et al. (2024); Morral-Yepes et al. (2023)
Reactive-agility test (perceptual decision plus movement)	Short multidirectional course; direction cued by an unpredictable stimulus after start	Response/completion time (s); shorter = better; Tier 2–3	Distinguish from preplanned COD; constant stimulus type, timing, alternatives, course, rules, timing; total time mixes perception and locomotion; stop for instability or collision risk	Ciocca et al. (2022); Morral-Yepes et al. (2023)
Repeated-sprint ability test (reproduce sprints with incomplete recovery)	Set number of short sprints, fixed brief recoveries; specify distance, reps, recovery, timing	Best, mean, total time and decrement (s, %); shorter and smaller decrement = better; Tier 2	Protocols not interchangeable; report distance, reps, work-to-rest, turnaround, timing, decrement method; mean time more stable than fatigue %; only if sport-justified, after speed and COD; stop for pain or altered mechanics	Asimakidis et al. (2025)
Standing horizontal jump (lower-limb horizontal explosive performance)	Two-foot take-off behind line, standard arm action, controlled landing, 2–3 valid trials	Distance (cm); greater = better; Tier 1	Constant start, arm action, take-off, landing, measuring point, trials, surface; reflects performance and body mass, not direct power; after warm-up, before sprint or endurance; nonslip landing	França et al. (2024); Ishida et al. (2021); Leão et al. (2022)

Test (construct)	Field protocol (brief)	Outcome (unit); reading; tier	Standardization, safety, and sequencing (key)	Sources
Countermovement jump (vertical explosive performance, stretch-shortening)	Rapid countermovement to maximal take-off; standard arms and depth; 2–3 valid trials	Height (cm), flight time; force-time if platform; greater height = better; Tier 1 (mat/app) / Tier 3 (force platform)	Constant arms, depth, take-off, landing, device, trials, rest; height alone is an explosive indicator; power and force-time need instrumentation; early in battery; postpone for acute lower-limb pain	Gisladottir et al. (2024); Ishida et al. (2021); Leão et al. (2022)
Handgrip strength (maximal isometric hand-forearm force)	Calibrated dynamometer, standard grip span and position, maximal contraction, 2–3 trials per hand	Force (kgf or N); higher = better; Tier 2	Constant device, grip, posture, hand, encouragement, duration, trials; general indicator, not sport-specific strength; low demand but stop for hand, wrist, elbow, or shoulder pain; avoid breath holding	Asimakidis et al. (2024)
Joint-mobility assessment (active/passive ROM: ankle, hip, shoulder)	Joint-specific test with standard landmarks, position, instructions, and device	Degrees, cm, or score; higher not always better; Tier 1 (field) / Tier 2 (goniometer)	Specify joint, plane, active/passive, landmarks, device, assessor, endpoint; sensitive to temperature, prior activity, pain; stop before pain or protective spasm; do not force end range in acute injury	Li et al. (2025)
Static or dynamic balance test (postural control)	Unipedal/bipedal or dynamic-reach task; set stance, surface, footwear, vision, trials	Time, reach, errors, or index; direction depends on protocol; Tier 1 (field) / Tier 2–3 (instrumented)	Constant type, stance, limb, surface, vision, duration, normalization, familiarization; static and dynamic are not interchangeable; supervise and protect against falls; stop for dizziness or instability	Collings et al. (2022); Li et al. (2025)
Borg CR10 rating of perceived exertion (perceived exertion)	Explain and anchor CR10 before testing; administer at a fixed moment, often immediately after	Score 0–10; higher = more exertion (not performance); Tier 1	Constant instructions, anchors, timing, wording; complements but does not replace objective data; no physical risk, but extremely high RPE relative to workload may prompt observation or referral	Borg (1998)

Note. CMJ = countermovement jump; COD = change of direction; CR10 = Category-Ratio 10 scale; ICC = intraclass correlation coefficient; IFT = intermittent fitness test; MDC = minimal detectable change; ROM = range of motion; RPE = rating of perceived exertion; SEM = standard error of measurement; VO_2max = maximal oxygen uptake. Resource tiers correspond to the decision algorithm in Figure 4 (Tier 1, minimal equipment; Tier 2, moderate or specialized field instrumentation; Tier 3, advanced laboratory, or wearable technology). Test selection should balance construct validity, reproducibility, feasibility, nonredundancy, measurement error, sport specificity, and safety. Neuromuscular tests should precede fatiguing repeated-sprint and intermittent-endurance tests. Sequence, warm-up, instructions, trials, recovery, equipment, surface, footwear, time-of-day window, and environmental conditions should remain constant across participants and repeated assessments. Time-based outcomes are read inversely to distance-, velocity-, height-, or force-based outcomes. Pre-window methodological references support administration but are not part of the contemporary evidence count.

Preparticipation, safety, injury, and prevention

This component addresses the third subquestion, concerning how amateur team-sport athletes are screened before assessment, what is known about their musculoskeletal injuries, and how prevention

connects back to the descriptive components. The synthesis moves from the safety gate to injury epidemiology, then to associated factors, and finally to prevention.

Preparticipation screening and safety criteria

The reviewed guidance framed preparticipation screening as a preventive, non-diagnostic process whose purpose is to identify conditions that warrant proceeding, adapting, postponing, or referring, rather than to certify fitness or guarantee the absence of risk (Weise et al., 2025). Screening typically combined personal and family medical history, current symptoms, and injury history, and it relied heavily on consensus recommendations, including criteria for not initiating a test, interrupting an ongoing test, and referring the athlete to an appropriate professional (Harmon et al., 2013; Weise et al., 2025). These stages, decisions, and referral criteria are organized in Table 5.

Table 5 Preparticipation Screening, Safety, Test-Interruption, and Referral Criteria

Stage	Criterion and indicators	Decision	Action (key)	Sources
Before session	Emergency preparedness: written EAP, communication, first aid, contacts, venue access, assigned roles	Proceed only if operational	Confirm emergency pathway; postpone high-intensity testing if resources unavailable	Scarneo-Miller et al. (2024)
Screening	Informed participation: understands purpose, exertion, risks, confidentiality, right to withdraw	Proceed / postpone / decline	Documented consent: clarify screening is preventive, not clearance	Weise et al. (2025)
Screening	Personal health history: cardiovascular, respiratory, neurological, metabolic, renal condition; prior surgery; adverse event; medication	Proceed / adapt / postpone / refer	Structured questionnaire: refer if it affects exercise safety	Weise et al. (2025)
Screening	Family cardiovascular history: premature sudden or unexplained death, inherited cardiac disease, arrhythmia	Refer before maximal testing	Recommend medical evaluation; do not diagnose or clear	Weise et al. (2025)
Screening	Cardio-respiratory warning symptoms: exertional chest pain, syncope, disproportionate dyspnea, palpitations, cyanosis	Do not initiate; refer; EAP if acute	Postpone and recommend timely evaluation; activate EAP if emergency	Scarneo-Miller et al. (2024); Weise et al. (2025)
Screening	Acute systemic illness: fever, infection, vomiting or diarrhea, uncontrolled condition, clinician restriction	Postpone; refer if unresolved	Do not begin strenuous testing; reschedule after recovery	Weise et al. (2025)
Screening	Musculoskeletal injury (current or previous): pain, swelling, instability, altered gait, recent injury or surgery, unresolved rehab, recurrent or same-region injury	Proceed with caution / adapt / postpone / refer	Test only what is safe; postpone loading the affected region; use injury history in interpretation, not alone to predict injury; refer beyond scope	Sonesson et al. (2023); Weise et al. (2025)

Stage	Criterion and indicators	Decision	Action (key)	Sources
Screening	Suspected or unresolved concussion: recent head impact, LOC, confusion, headache, dizziness, balance or visual symptoms, persistent post-concussion symptoms	Do not test; remove and refer	Remove-and-refer; no same-day return; graduated clinical progression	Patricios et al. (2023)
Screening	Medication or substance affects heart rate, BP, alertness, coordination, thermoregulation, or pain; stimulants	Proceed / adapt / postpone / refer	Record use without altering treatment; seek guidance for interactions	Weise et al. (2025)
Pretest	Inadequate recovery or preparation: sleep loss, recent strenuous exercise, fasting, dehydration, alcohol, heat, or cold outside protocol	Adapt / postpone	Reschedule if safety or comparability compromised; document deviations	Weise et al. (2025)
Pretest	Equipment, surface, environment: damaged or uncalibrated gear, unstable or obstructed surface, insufficient space, unsafe temperature or lighting, wrong footwear	Do not initiate until corrected	Correct hazard, change location, adapt, or postpone	Scarneo-Miller et al. (2024); Weise et al. (2025)
Administration	Expected exertional response (no warning signs): proportionate fatigue, ventilation, sweating, resolving in recovery	Proceed with monitoring	Continue per protocol; terminate at predefined completion criteria	Weise et al. (2025)
Interruption	Cardiovascular warning signs: chest pain, syncope, marked dizziness, palpitations, cyanosis, pallor, collapse	Stop immediately; EAP or refer by severity	Terminate, position safely, basic assessment, activate EAP; do not resume in session	Scarneo-Miller et al. (2024); Weise et al. (2025)
Interruption	Abnormal respiratory response: severe dyspnea, wheeze with compromise, cannot speak, distress, oxygenation concern	Stop immediately; treat within scope, refer or EAP	Terminate exertion; follow emergency pathway; do not restart	Scarneo-Miller et al. (2024); Weise et al. (2025)
Interruption	Acute musculoskeletal symptoms: sudden or increasing pain, suspected strain or sprain, joint giving way, swelling, cannot bear weight	Stop the test; assess and refer	Discontinue loading; immediate care within competence; clinical evaluation	Weise et al. (2025)
Interruption	Neurological or motor-control signs: new confusion, ataxia, visual disturbance, severe headache, weakness, altered responsiveness, seizure	Stop immediately; EAP or refer	Protect from further activity; activate EAP; no same-session return	Patricios et al. (2023); Scarneo-Miller et al. (2024)
Interruption	Volitional termination or unsafe protocol: requests to stop, cannot maintain pace or technique, excessive fatigue, unsafe mechanics	Stop the test	Respect for withdrawal; no pressure; judge result validity	Weise et al. (2025)

Stage	Criterion and indicators	Decision	Action (key)	Sources
Post-test	Immediate recovery: heart rate, breathing, orientation, gait, skin, or symptoms not normalizing; delayed dizziness, nausea, or pain	Observe / stop session / refer	Supervise recovery; do not dismiss while symptoms persist; EAP if deterioration	Scarneo-Miller et al. (2024); Weise et al. (2025)
Post-test	Incident or adverse-event reporting: unexpected symptoms, injury, near miss, emergency response, safety interruption	Record and review before further participation	Complete incident report, protect confidentiality, evaluate protocol change or referral	Scarneo-Miller et al. (2024)
Referral	Findings outside scope: persistent pain, unresolved injury, concerning cardiovascular, respiratory, neurological, metabolic, nutritional, or psychological finding, abnormal recovery	Refer	Direct to medicine, physiotherapy, rehabilitation, nutrition, or psychology; avoid out-of-scope diagnoses	Patricios et al. (2023); Weise et al. (2025)
Return	Resolution or professional management: symptoms resolved, limitation addressed, recommendation obtained, meets pretest conditions	Resume / adapt / continue postponement	Repeat readiness screening; resume only safe, permitted tests	Patricios et al. (2023); Weise et al. (2025)
Principle	Preventive and non-diagnostic: screening flags caution, adaptation, postponement, or referral; no diagnosis or guarantee of safety	Apply proportional judgment	Communicate as screening observations; avoid "cleared" or "injury-proof" claims; keep confidential and non-stigmatizing	Weise et al. (2025)

Note. Decision codes: proceed, continue under the standardized protocol; adapt, modify test or sequence without compromising safety or interpretability; postpone, defer until the condition resolves; stop, terminate an ongoing test; refer, indicate assessment by a qualified professional. EAP = emergency action plan; LOC = loss of consciousness; BP = blood pressure. For every criterion, document the relevant finding, action, and disposition confidentially, without stigmatizing language, and on a need-to-know basis, distinguishing observed data from clinical interpretation. Preparticipation screening is a preventive decision-support process, not a diagnosis, a guarantee of safety, or unrestricted medical clearance; much of the guidance remains consensus-based and requires proportionate interpretation. Weise et al. (2025) provide the principal synthesis for general preparticipation evaluation; Patricios et al. (2023) support the concussion criteria; and Scarneo-Miller et al. (2024) support emergency action planning and incident response.

Epidemiology of musculoskeletal injuries in amateur team sport.

Descriptive evidence indicated that reduced-contact modalities are not injury-free. In flag football, reported injuries involved the hand and fingers, knee, and ankle, and included sprains, strains, and fractures, which supports surveillance of both the upper and lower extremities despite the modality's rules (Balachandran et al., 2025; Barber Foss et al., 2023). Injury patterns in female American football varied by age group, and the differences in contact exposure, rules, and equipment caution against transferring those findings directly to flag football (Mao et al., 2025). In soccer and rugby, amateur cohorts documented meaningful injury occurrence, with sex-disaggregated patterns in rugby and prospective injury occurrence in amateur soccer (Prieto-González et al., 2021; Sonesson et al., 2023;

Yeomans et al., 2021). Additional rugby evidence characterized incidence, severity, mechanism, and anatomical distribution, described temporal trends by sex, and mapped the gaps in women's rugby, where epidemiological data remain comparatively scarce (Bellingan et al., 2025; Marrese et al., 2025; Yendluri et al., 2024). A notable gap across the corpus is the limited adult amateur and Latin American epidemiological evidence, especially for flag football, a point summarized in Table 6.

Intrinsic, biomechanical, and body-related associated factors

The literature examined factors associated with non-contact lower-limb injury, including strength, biomechanics, inter-limb asymmetries, neuromuscular control, and previous injury, and it increasingly framed these within multifactorial rather than single-factor models. Non-contact anterior cruciate ligament injury in women served as a paradigmatic case, with syntheses and prospective work identifying candidate strength and biomechanical indicators and recurring injury mechanisms, while cautioning that such indicators are not validated individual predictors (Achenbach et al., 2024; Chia et al., 2022; Collings et al., 2022; Mancino et al., 2024). Reviews of women's football reinforced sex-specific considerations for injury and prevention (John et al., 2025), and a structural equation model of male footballers represented intrinsic characteristics as interdependent rather than isolated predictors, which supports a systems-oriented reading and cautions against single-test decisions (Liveris et al., 2025). Consistent with the screening evidence, previous injury and higher age were prospectively associated with subsequent injury in amateur players (Sonesson et al., 2023), and body-composition and fitness variables have been combined within multivariable injury-prediction models, an approach that bridges the descriptive components to the injury component while requiring independent validation (Martins et al., 2022).

These associated factors are compiled in Table 6, and their bidirectional, non-causal relationship with body profile and performance is represented in Figure 3.

Table 6 Epidemiology, Associated Factors, and Prevention of Musculoskeletal Injuries in Team Sports

Study	Setting and population	Design	Domain and main contribution	Applied reading; caveat
Balachandran et al. (2025)	USA; women, flag football	10-yr epidemiological review	Distribution and type: hand, fingers, knee, ankle; sprains, strains, fractures	Include upper- and lower-limb surveillance despite reduced-contact rules; caveat: level, exposure, injury definition pending
Barber Foss et al. (2023)	USA; youth flag football	Descriptive epidemiology	Game-related injury occurrence	Reduced contact is not absence of MSK risk; caveat: youth data not transferable to adults
Mao et al. (2025)	USA; female American football, age-stratified	Age-stratified epidemiology	Injury patterns 2015–2024 vary by age	Age-specific surveillance and prevention; caveat: American football differs from flag football
Prieto-González et al. (2021)	Spain; adolescent athletes	Injury surveillance	Incidence, location, candidate factors	Interpret by age, exposure, development; caveat: mixed-sport or adolescent may not represent adult amateurs
Sonesson et al. (2023)	Sweden; amateur M/F soccer	Prospective cohort	Higher age and baseline injury prospectively associated with in-season injury	Record current symptoms and prior injury at screening; caveat: association, not individual prediction
Mandorino et al. (2023)	International; youth soccer	Systematic review	Incidence, distribution, candidate factors	Basis for age-appropriate prevention; caveat: heterogeneous definitions, exposure, quality
Chia et al. (2022)	International; team ball sports	SR + meat-analysis	Noncontact ACL by sex, age, sport, level, exposure	Sex- and sport-sensitive interpretation; caveat: pooled estimate is not modality-specific individual risk
Collings et al. (2022)	Australia; elite women footballers	Prospective observational	Strength and biomechanics as candidate ACL indicators	Neuromuscular assessment adds context; caveat: elite female surrogates, limited transfer
Achenbach et al. (2024)	Germany; professional women	Observational injury-pattern	Four recurring ACL injury patterns	Inform movement-specific prevention and video analysis; caveat: patterns are not a validated screening tool
Mancino et al. (2024)	UK; female athletes	Narrative review	Anatomical, biomechanical, hormonal, training ACL factors	Multifactorial, sex-informed prevention; caveat: narrative bias, no pooled estimate
John et al. (2025)	International; women's football	Review	Sex-specific injury considerations	Sex-adapted prevention; caveat: review type and appraisal need verification
Liveris et al. (2025)	Pending; male football	Structural equation modeling	Interrelated intrinsic factors, noncontact lower-limb injury	Systems view; caution against single-test decisions; caveat: model fit is not causation, needs external validation

Study	Setting and population	Design	Domain and main contribution	Applied reading; caveat
Yeomans et al. (2021)	Ireland; amateur M/F rugby	Comparative epidemiology	Injury patterns differ by sex	Sex-disaggregated surveillance; caveat: exposure, role, and reporting differences
Marrese et al. (2025)	Brazil; rugby union	Epidemiological	Incidence, severity, mechanism, region	Prioritize prevention by common sites and mechanisms; caveat: level, definition, duration, denominator pending
Yendluri et al. (2024)	USA; M/F rugby	Epidemiological trend	Trends 2008–2022; persistent noncontact knee injury in women	Continue sex-specific surveillance; caveat: coding, participation, and exposure limits
Bellingan et al. (2025)	International; women's rugby	Scoping review	Epidemiology, factors, gaps	Priorities for future research; caveat: maps breadth, no pooled effect
Martins et al. (2022)	Portugal; elite football	Predictive modeling	Injury prediction from body composition and fitness	Shows potential and limits of combined field variables; caveat: elite, overfitting, needs validation
Lemes et al. (2021)	International; 13,355 athletes	SR + meat-analysis	Exercise-based prevention of noncontact MSK injury	Structured preventive exercise helps with delivery and adherence; caveat: varied content, definitions, adherence
Bullock et al. (2025)	International; female athletes	SR + consensus framework	Lower-extremity prevention	Sex-informed multicomponent programs; monitor fidelity; caveat: separate consensus from comparative evidence
Liu et al. (2026)	International; ages 10–19	SR + meat-analysis	Multicomponent prevention	Neuromuscular and multicomponent prevention with sufficient dose and adherence; caveat: adolescent, do not overgeneralize
Jaskulski et al. (2025)	Poland; women's rugby	8-wk intervention	Sensorimotor and knee injury-related indicators	Sensorimotor training within preparation; caveat: surrogate outcomes are not reduced injury incidence
Cardoso-Marinho et al. (2022)	International; football	Systematic review	Injury-risk perception and preventive behavior	Athlete beliefs and engagement matter for adherence; caveat: perception is not incidence or susceptibility

Note. ACL = anterior cruciate ligament; MSK = musculoskeletal; M = men; W = women; SR = systematic review. The term risk factor is reserved for longitudinal evidence in which an exposure precedes and predicts the injury; cross-sectional, biomechanical, and model-derived variables are described more cautiously as associated factors, candidate indicators, or injury-related characteristics. Improvements in strength, balance, movement quality, or neuromuscular control are not interpreted as reductions in injury incidence unless actual injuries were measured over a defined exposure period. The evidence base is concentrated in soccer and rugby, includes a substantial proportion of female and youth populations, and offers comparatively limited epidemiological evidence for adult amateur flag football; this asymmetry is treated as a central finding and a limitation of transferability. Preventive programs should be interpreted in relation to content, exposure, adherence, implementation of fidelity, and injury definition.

Prevention programs and risk perception

Intervention evidence indicated that exercise-based neuromuscular and multicomponent programs are associated with reduced non-contact musculoskeletal injury when they are adequately delivered and adhered to (Lemes et al., 2021), and consensus-oriented syntheses for the female athlete emphasized sex-informed, multicomponent prevention and the decisive role of implementation fidelity (Bullock et al., 2025). Multicomponent programs were likewise associated with reduced injury in adolescent team-sport participants when dosage and adherence were sufficient (Liu et al., 2026), and sensorimotor and knee-focused training modified neuromuscular indicators, although surrogate improvements should not be equated with reduced injury incidence unless injuries and exposure were measured (Jaskulski et al., 2025).

Pragmatic implementation frameworks addressed how such programs are adopted and sustained in real settings (Patterson et al., 2022), and functional training improved modifiable movement-quality and fitness qualities that prevention programs target (Li et al., 2025). Because adherence depends on athletes' beliefs and engagement, risk perception emerged as a relevant implementation outcome rather than a measure of injury susceptibility (Cardoso-Marinho et al., 2022). Taken together with the epidemiological synthesis (Mandorino et al., 2023), these findings close the analytic loop: prevention presupposes a prior diagnostic phase, so that Components I and II are the descriptive basis on which Component III acts, an articulation represented in the integrative framework (Figure 1).

DISCUSSION

Integrating the three components: a resource-proportional framework.

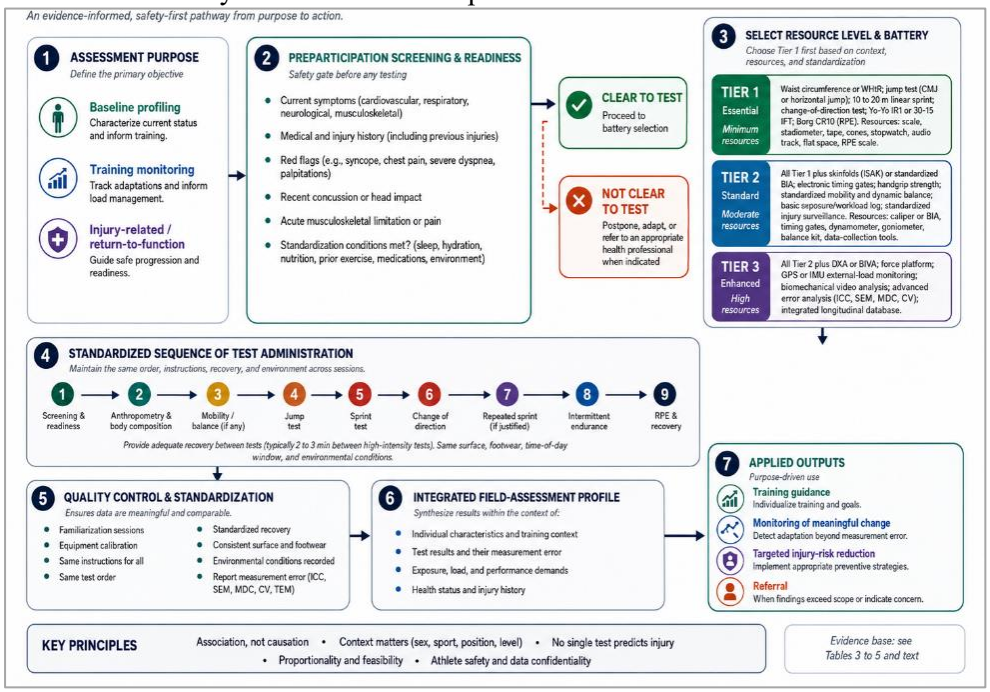
The central result of this review is not a list of indicators but an articulation among them. Preparticipation screening, anthropometry, and functional performance behaved not as independent checklists but as an ordered system, in which screening operates as the entry gate that authorizes assessment, while anthropometry and functional performance act as descriptors that feed a resource-proportional field-assessment battery serving two applied aims, training guidance and injury prevention. Read this way, the body profile is informative only when interpreted purposefully and ethically rather than as a verdict about an athlete's diet or worth, a stance that the applied literature on body composition makes explicit (Mathisen et al., 2023).

Nutrition enters the framework as a transversal dimension of body status rather than as a separate axis of judgment, consistent with expert guidance on football nutrition and with descriptive work relating nutritional status to performance in players (Collins et al., 2021; Oukheda et al., 2024). The empirical practice of combining body-composition and fitness variables within multivariable injury-risk models illustrates the same integration in miniature, since it links the descriptive components to the injury component while still requiring independent validation (Martins et al., 2022). This articulation is represented in the integrative framework shown in Figure 1.

A proposed field-assessment battery for amateur team sport

The second contribution is a minimum viable, resource-proportional battery. The reviewed evidence on test selection and standardization supports a battery organized by an explicit administration order, in which neuromuscular, jump, speed, and change-of-direction tests precede fatiguing repeated-sprint and intermittent-endurance tests, and in which familiarization, standardized instructions, invalidation criteria, and safety rules are specified in advance (Asimakidis et al., 2024, 2025; Bangsbo et al., 2008). The battery is transferable across team modalities and is organized in three resource tiers, essential, standard, and enhanced, so that a team can assess meaningfully with minimal equipment and scale up only when resources and standardization capacity allow. Crucially, the highest tier is not automatically superior; the battery must match the assessment question and the setting, and it must remain subordinate to the safety gate described in the preparticipation evidence (Weise et al., 2025). This decision logic consolidates the tests and safety criteria compiled in Tables 4 and 5 and is presented as an algorithm in Figure 4.

Figure 4 Decision Algorithm for Selecting and Administering a Resource-Proportional Field-Assessment Battery in Amateur Team Sport



Note. The algorithm proceeds from the assessment purpose through a preparticipation safety gate to the selection of a resource-proportional battery organized in three tiers (essential, standard, and enhanced), followed by a standardized test-administration sequence, quality control, and an integrated profile that informs purpose-driven outputs. Tier 3 is not automatically superior; the battery must match the assessment question and the available resources. Association is not interpreted as causation, and no single test predicts injury. Own elaboration, informed by the evidence synthesized in Tables 3 to 5.

Heterogeneity by sex, sport, and level as the interpretive axis

The third contribution is analytic rather than instrumental: the corpus is markedly asymmetric, and asymmetric structures interpretation. The performance evidence was predominantly male and soccer-based, whereas the injury evidence was predominantly female and concentrated in soccer and rugby, and the epidemiological evidence for flag football was incipient and largely from the United States (Bellingan et al., 2025; Hernandez-Martinez et al., 2024; Ramírez-Munera et al., 2025; Toro-Román et al., 2023). This distribution means that a profile or a risk pattern established in one population cannot be assumed to hold in another, and that reference values and injury priorities should be interpreted, and reported, with stratification by sex, sport, and competitive level (Balachandran et al., 2025; John et al., 2025; Mao et al., 2025). Treating these modulators as a central axis, rather than as a closing caveat, is what protects the review's conclusions from over-generalization, and the modulated, bidirectional character of the relationships among the components is represented in Figure 3 and summarized in the source characteristics of Table 2.

Association versus causation and the quality of the evidence

Two cautions temper every inference drawn here. First, the reviewed primary evidence was predominantly cross-sectional and observational, which supports statements about how variables co-vary but not about how one produces another; establishing that an exposure precedes and predicts an injury requires prospective designs with adequate exposure follow-up, and pooled or model-derived associations should not be read as modality-specific individual risk (Chia et al., 2022; Mandorino et al., 2023; von Elm et al., 2007). The under-reporting of measurement error across applied testing further limits how confidently slight differences can be interpreted (Asimakidis et al., 2024). Second, the method of this review imposes its own limits: identification was restricted to a single database, and title and abstract screening was artificial-intelligence-assisted and tuned for sensitivity, with full-text confirmation still pending. These procedures are defensible and transparent, and recent evidence supports the assisted screening of records against explicit criteria, but they warrant the same interpretive prudence the review applies to its sources (Khraisha et al., 2024; Oami et al., 2024).

Applied and educational implications

For practitioners in amateur, university, and semi-professional settings, the framework and battery offer a feasible path from observation to measurement without laboratory resources, if data are collected and communicated confidentially and without stigmatizing language (Kasper et al., 2021; Mathisen et al., 2023). The preparticipation gate provides a proportionate, non-diagnostic basis for deciding whether to proceed, adapt, postpone, or refer, and it clarifies when a finding exceeds the assessor's scope and warrants referral (Weise et al., 2025). Because the effectiveness of any preventive program depends on adherence, and adherence depends on athletes' beliefs and engagement, the educational task of building accurate risk perception is inseparable from the technical task of assessment (Cardoso-Marinho et al., 2022). In this sense, the review's applied value lies less in any single test than in a coherent, safety-first, resource-aware way of assessing amateur team-sport athletes.

Limitations

Several limitations qualify the scope and the conclusions of this review. First, the heterogeneity of the corpus, spanning different sports, sexes, competitive levels, instruments, and outcomes, precluded any statistical pooling, so the synthesis is descriptive and maps the direction and breadth of the evidence

rather than a summary effect. Second, identification was restricted to a single bibliographic database, PubMed/MEDLINE; although the title-anchored strategy favored precision, this choice introduces a coverage boundary, and a fully exhaustive map would additionally interrogate Scopus, Web of Science, SPORTDiscus, SciELO, and Dialnet. Third, title and abstract screening was performed autonomously with a large language model tuned for sensitivity, and full-text confirmation of the provisionally included sources remains a pending verification step; while recent evidence supports artificial-intelligence-assisted screening against explicit criteria, this procedure warrants human verification before the corpus is considered final (Khraisha et al., 2024; Oami et al., 2024).

Fourth, the evidence base is markedly asymmetric, with performance data concentrated in male soccer, injury data concentrated in female soccer and rugby, and only incipient, largely United States epidemiological evidence for adult amateur flag football, which limits transferability to Latin American and other underrepresented populations (Balachandran et al., 2025; Barber Foss et al., 2023; Bellingan et al., 2025). Fifth, the language restriction to English, Spanish, and Chinese, together with variable access to full texts, may have introduced language and availability bias. Sixth, most primary evidence was cross-sectional and observational, so the associations reported here cannot establish causation, and the proposed field-assessment battery, although grounded in the reviewed evidence, has not yet been validated.

CONCLUSIONS

This scoping review mapped recent evidence on field-based anthropometric, functional, and preparticipation assessment in amateur team-sport athletes and examined how these indicators relate to physical performance and to musculoskeletal injury history and risk. In response to the review question, the evidence supports assessing the amateur athlete through three articulated components rather than isolated measurements: a preparticipation safety gate, a multidimensional body profile in which body mass index is a limited indicator requiring complementary measures of central adiposity and body composition, and a field battery of intermittent endurance, speed, change of direction, and explosive strength interpreted alongside mobility, balance, and neuromuscular control. Addressing the subquestions, the relationships among body profile, performance, and injury were consistently

associative, non-linear, and bidirectional, and they were strongly modulated by sex, sport, and competitive level.

The review's contribution is threefold: an integrative framework that orders these components (Figure 1), a resource-proportional and transferable field-assessment battery presented as a decision algorithm (Figure 4), and a critical synthesis that foregrounds the heterogeneity and direction of the evidence rather than a single estimate. These conclusions are offered with deliberate causal prudence: no single test predicts injury, and description precedes prevention. Accordingly, the research agenda that follows is clear. Future work should prioritize prospective designs with adequate exposure follow-up, stratified by sex, sport, and competitive level, that report measurement error explicitly, complete full-text verification of the provisional corpus, and validate the proposed battery locally, including in Mexican and broader Latin American amateur populations, where the evidence remains scarcest.

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