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Physical fitness profiles of football players across competitive levels in southeast asia: a systematic review

Vega Soniawan*), Ikhwanul Arifan
Universitas Negeri Padang, Indonesia

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ABSTRACT

Football is the most widely practised team sport in Southeast Asia, yet regional teams continue to underperform relative to international benchmarks, and the physical fitness evidence underpinning player development remains fragmented across countries and competitive tiers. This systematic review synthesises how physical fitness has been characterised among football players in Southeast Asia and how the reported profiles differ across competitive levels. The review followed the PRISMA 2020 framework. A Boolean search of Scopus using TITLE-ABS-KEY, combining football, physical fitness and Southeast Asian country terms, retrieved 4,122 records. Eligibility was restricted to English-language journal articles published in final stage between 2021 and 2025 that reported at least one standardised physical fitness outcome for football players sampled in a Southeast Asian country; reviews, non-player populations and studies without fitness outcomes were excluded. After duplicate removal, filtering and screening, 53 reports were assessed in full text and 22 studies were included. Aerobic capacity and linear speed dominated the evidence base, whereas flexibility, balance and anaerobic power were rarely profiled, and professional and female cohorts were markedly underrepresented. The findings support level-specific testing batteries and a harmonised regional normative database, and future work should prioritise longitudinal, cross-level and female-focused designs.

Corresponding Author:

Vega Soniawan,
Universitas Negeri Padang,
Email: vegasoniawan@fik.unp.ac.id

Introduction

Association football is the most widely practised team sport worldwide, and the physical demands imposed by the modern game have intensified markedly over the past two decades. Match play requires players to sustain intermittent high-intensity efforts, repeated accelerations and decelerations, and frequent changes of direction interspersed with incomplete recovery, so that aerobic capacity, sprint speed, agility and muscular power jointly determine the ability to reproduce decisive actions across ninety minutes (Carvalho et al., 2025; Sousa et al., 2024). Contemporary tracking technology has rendered these demands quantifiable at the level of the individual player, showing that locomotor output varies systematically with playing position, contextual factors and the competitive standard of the fixture (Chainok et al., 2025; Sousa et al., 2024). Physical fitness is therefore no longer treated as a generic conditioning by-product but as a structured, testable profile that underpins talent identification, training prescription and injury mitigation across the entire football pathway.

Southeast Asia presents a distinctive case within this global picture. The region houses more than 670 million people among whom football commands unrivalled popular support, yet its national teams have historically struggled to convert mass participation into sustained international competitiveness. Investment in academies, national development programmes and university competition has expanded rapidly, and structures such as Malaysia's National Football Development Programme, the Thai professional league system and Indonesia's school- and club-based soccer academies now channel large cohorts of young players into formalised training (Jatmiko et al., 2024; Nuttouch et al., 2023b; Rosdi et al., 2025). At the same time, players in the region train under environmental, nutritional and infrastructural conditions that differ substantially from those in Europe, so normative fitness values imported from European cohorts may misrepresent regional capacity (Kharsynniang, 2025; Nuttouch et al., 2023a). Establishing what regional players actually achieve on standardised tests is therefore a precondition for evidence-informed development.

A body of primary research addressing this question has accumulated across the region, although it has grown in a dispersed rather than a programmatic fashion. Descriptive and correlational work has profiled anthropometric and physiological attributes in youth and amateur cohorts (Sanpasitt et al., 2023; Yusni et al., 2025), examined the association between fitness clusters and injury patterns in national development programmes (Rosdi et al., 2025), and quantified positional workloads in senior international players using satellite tracking (Nuttouch et al., 2023a). Parallel intervention research has tested pre-season conditioning, small-sided games and high-intensity protocols in academy, university and professional settings (Ahmad et al., 2024; Madarsa & Mohamad, 2022; Norrahmah et al., 2025). Related evidence has also emerged from adjacent populations in the region, including referees, para-athletes and players of other invasion sports (Jakiwa et al., 2023; Mudian et al., 2021; Sukriadi et al., 2023; Tajudin et al., 2022), signalling a widening but still uncoordinated regional research agenda.

Methodologically, the field has moved quickly. Global positioning systems, inertial sensors and validated field batteries have made external-load quantification routine, allowing training intensity to be matched to match demands rather than to coaching intuition (Quan et al., 2024; Sousa et al., 2024). Training science has converged on time-efficient stimuli, with small-sided games, high-intensity interval formats, plyometric loading and speed-agility-quickness protocols repeatedly shown to improve aerobic and neuromuscular qualities in football populations (Deng et al., 2023; Firmansyah et al., 2024; Liu et al., 2024a; Sun et al., 2025). Microdosed and supervised off-season prescriptions have further been proposed to protect adaptations during competitive breaks (Liu et al., 2024b; Panascì et al., 2025), while combined small-sided game and interval formats have been trialled in collegiate and youth female cohorts (Deep et al., 2025; Prasad et al., 2025). These advances make cross-context comparison feasible in principle, provided that the underlying profiling evidence is systematically mapped.

The first gap concerns competitive level. Although the notion that fitness qualities discriminate between playing standards is foundational to talent identification, the regional literature is dominated by single-cohort studies that describe one squad, one academy or one league tier at a time. Cross-level comparison, where it exists, is largely implicit and must be reconstructed by juxtaposing studies that used different protocols, age bands and reporting conventions (Purba & Susanti, 2021; Sanpasitt et al., 2023; Yusni et al., 2025). No synthesis has yet asked whether the youth, elite youth, collegiate, amateur and professional tiers in Southeast Asia are characterised by systematically different fitness profiles, or whether the apparent differences simply reflect divergent testing choices. Without that mapping, coaches lack a defensible basis for deciding which qualities warrant emphasis at which stage of the regional pathway.

The second gap is methodological and representational. Protocol heterogeneity is pronounced: aerobic capacity has been indexed through multistage shuttle running, Yo-Yo intermittent recovery testing and distance-based field runs, each yielding non-interchangeable values, while agility, power and flexibility are assessed inconsistently or omitted altogether. Several regionally produced studies have prioritised nutritional supplementation, passive recovery modalities or biochemical markers over fitness profiling itself (Adji et al., 2022; Fajar et al., 2025; Mulyawan et al., 2023; Welis & Mario, 2023), and others have addressed injury knowledge rather than measured capacity (Som et al., 2022). Female players, professional squads and comparative disability cohorts remain thinly represented relative to the volume of youth male research (Alexe et al., 2024; Yapici et al., 2023), leaving substantial segments of the regional football population without normative reference values. A systematic mapping is therefore both timely and necessary. Regional competition has intensified through the expanded Southeast Asian Games and continental qualifying cycles, naturalisation and diaspora recruitment have raised public expectations of physical parity with stronger footballing nations, and grassroots participation continues to widen into preschool and school settings (Jia et al., 2021; Siramaneerat & Chaowilai, 2022; Xu & Xie, 2024; Siby et al., 2025). Practitioners require a consolidated account of what has been measured, in whom, and with which instruments before regional normative standards can be constructed.

Accordingly, this review consolidates the peer-reviewed evidence published between 2021 and 2025 on the physical fitness of football players sampled in Southeast Asia, and organises that evidence explicitly by competitive level. Three research questions guide the synthesis and, taken together, deliver the first level-stratified evidence map for football fitness in this region.

RQ1: Which physical fitness components have been assessed among football players in Southeast Asia in the peer-reviewed literature published between 2021 and 2025?

RQ2: How do the reported physical fitness characteristics differ across competitive levels, namely youth or development, elite youth, collegiate, amateur, and professional or elite senior players?

RQ3: Which assessment protocols and testing methods are most frequently applied to evaluate the physical fitness of football players across competitive levels in Southeast Asia?

Answering these three questions delivers the first level-stratified evidence map of football fitness in Southeast Asia, establishes which components and protocols the region already supports, and identifies with precision where the regional evidence base must be extended before harmonised normative standards can be issued.

Methods

A systematic literature review was selected as the research design because the objective was to consolidate and critically appraise a dispersed body of primary evidence rather than to generate new empirical data. The systematic review method offers a transparent, replicable and auditable procedure for locating, appraising and synthesising studies that address a defined question, and it constrains the reviewer's discretion at each stage through pre-specified decision rules (Tranfield et al., 2003). Compared with narrative overviews, this design substantially reduces selection bias and permits readers to reconstruct how the final evidence base was assembled (Liberati et al., 2009).

The review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement (Page et al., 2021a), with procedural decisions guided by the accompanying explanation and elaboration document (Page et al., 2021b). PRISMA 2020 was adopted because it specifies the full reporting architecture required of a contemporary review, including the identification, screening, eligibility and inclusion phases represented in the flow diagram, the documentation of automated filters applied at the database interface, and the explicit statement of exclusion reasons at full-text stage. A meta-analysis was not attempted: the heterogeneity of protocols, age bands and competitive levels across the retrieved evidence precluded meaningful statistical pooling, so a qualitative thematic synthesis was adopted instead.

Before the search string was constructed, the research questions were decomposed using the PICOS framework, an extension of PICO that adds study design and is well suited to reviews in which design heterogeneity is anticipated (Methley et al., 2014). Each element was translated into a cluster of synonyms and morphological variants, and the clusters were then combined with Boolean operators. Table 1 sets out the operationalisation of each element in this review.

Table 1. PICOS Framework Used to Structure the Search Strategy

PICOS element	Operationalisation in this review
Population (P)	Association football (soccer) players of any age and sex whose sample was recruited in a Southeast Asian country: Indonesia, Malaysia, Thailand, Vietnam, the Philippines, Singapore, Brunei Darussalam, Cambodia, Laos, Myanmar or Timor-Leste. Search cluster: football, soccer, futsal, player, athlete, and the country and demonym stems.
Interest / Intervention (I)	Assessment, profiling or targeted development of one or more physical fitness components through standardised laboratory tests, validated field protocols or match tracking systems. Search cluster: physical fitness, physical performance, physical capacity, aerobic capacity, VO2max, endurance, sprint, agility, muscular power, anthropometry.
Comparison (C)	Comparison between competitive levels (youth or development, elite youth, collegiate, amateur, professional or elite senior), between playing positions, or between intervention and control conditions. Studies reporting a single-level profile without a comparator remained eligible, since a descriptive profile answers RQ1 and RQ3.
Outcome (O)	At least one quantified physical fitness outcome: aerobic capacity or cardiorespiratory endurance, linear speed, agility or change of direction, muscular power, muscular strength or endurance, anaerobic capacity, flexibility, dynamic balance, or body composition and anthropometry.
Study design (S)	Primary quantitative studies of any design: descriptive, correlational, comparative cross-sectional, quasi-experimental and randomised controlled designs. Secondary studies, protocols and commentaries were not eligible.

Boolean search string
(("soccer" OR "football" OR "association football") AND ("physical fitness" OR "physical performance" OR fitness OR "physical capacity" OR "physical characteristics" OR "fitness profile*" OR "physical profile*" OR "performance profile*") AND ("competitive level*" OR "competition level*" OR "playing level*" OR "performance level*" OR "elite" OR "sub-elite" OR amateur* OR professional* OR collegiate OR university OR academy OR youth OR adolescent* OR junior* OR senior*))

The search string was executed in the Scopus advanced search interface. Truncation was applied to capture morphological variants without inflating the string, so that sprint* retrieved sprint, sprints, sprinting and sprinter, anthropometr* retrieved anthropometry, anthropometric and anthropometrical, and country stems such as Malaysia*, Indonesia* and Thai* retrieved both the country name and the corresponding demonym. The field code TITLE-ABS-KEY restricted matching to the title, abstract and keyword fields, which balances sensitivity against the noise generated by full-text matching. Four limiters were applied at the interface and are reported here because they materially shaped the yield: publication years were bounded to 2021 through 2025 to capture the current evidence cycle and to avoid conflating pre-pandemic and post-pandemic training contexts, This timeframe was selected to capture the most current evidence cycle and to avoid conflating data from pre-pandemic and post-pandemic training contexts, a period characterized by significant disruptions to football development pathways and research continuity; document type was limited to article to exclude conference material, editorials and errata; source type was limited to journal to ensure peer review; publication stage was limited to final to exclude in-press records whose bibliographic details are unstable; and language was limited to English, the working language of the review team.

The string was piloted iteratively. An initial version omitting the population cluster returned a large volume of records concerning football as a public-health activity rather than as competitive sport, and a second version restricting the outcome cluster to physical fitness alone suppressed relevant match-analysis studies that report locomotor capacity under other labels. The final string, reproduced below, therefore combines four clusters and was verified by confirming that a set of ten known relevant regional articles was retrieved before the string was locked. The PICOS framework served solely to structure the search strategy and is analytically distinct from the quality appraisal procedure which applied the Mixed Methods Appraisal Tool.

Scopus was employed as the primary and sole database for this review, a decision that was deliberate and is reported transparently. This choice was predicated on the specific nature of the field; the regional sport science literature pertinent to Southeast Asian football is predominantly published in local and national journals, many of which are comprehensively indexed in Scopus. This includes titles from universities and sports academies across Indonesia, Malaysia, and Thailand. While databases like PubMed or Web of Science index a broader and more international range of biomedical literature, they may not offer the same extensive coverage of these regionally specific outlets. We acknowledge this methodological choice as a constraint of the study design, which is further discussed in the limitations section. The eligibility framework applied at every screening stage is set out in Table 2. Each criterion was operationalised as a binary decision rule so that screening decisions could be recorded and audited.

Table 2. Inclusion and Exclusion Criteria Applied at Screening and Full-Text Assessment

Criterion	Inclusion	Exclusion
Language	English	Any language other than English
Document type	Journal article	Conference paper, book chapter, editorial, note, letter, erratum, short survey
Source type	Peer-reviewed journal	Book series, trade publication, conference proceedings
Publication stage	Final	Article in press
Publication period	2021 to 2025 inclusive	Published before 2021
Population	Football or soccer players whose sample was recruited in a Southeast Asian country	Samples recruited outside Southeast Asia; non-player populations such as referees, coaches or spectators; participants from other sports
Outcome	At least one standardised physical fitness outcome reported quantitatively	Studies reporting only technical, tactical, psychological, biochemical, nutritional, or knowledge and attitude outcomes; instrument development without fitness data; performance analytics without player testing
Competitive level	Competitive standard of the sample explicitly stated or unambiguously inferable	Competitive level neither reported nor inferable from the sampling description

Criterion	Inclusion	Exclusion
Study design	Primary quantitative study	Systematic review, meta-analysis, scoping review, review protocol, commentary; a second report of a dataset already represented in the corpus
Accessibility	Full text retrievable by the review team	Abstract only; full text not obtainable

Study selection proceeded through three sequential stages. In the first stage, the exported metadata were deduplicated and the interface eligibility filters were applied, removing 14 duplicate records and 3,846 records that did not satisfy the year, document type, source type, publication stage or language criteria, leaving 262 records for screening. In the second stage, titles and abstracts of these 262 records were screened against the population, outcome and geographical criteria; 197 records were excluded because they were not football specific, reported no physical fitness outcome, or sampled players outside Southeast Asia. The 65 remaining reports were sought for retrieval, of which 12 could not be obtained in full text.

In the third stage, the 53 retrievable reports were read in full and assessed against the complete eligibility framework in Table 2, yielding 22 included studies. Screening was performed independently by two reviewers working from a shared screening form, with records managed in a reference manager and a systematic review screening application (Ouzzani et al., 2016). Disagreements at title and abstract stage were resolved by discussion; the four disagreements that persisted at full-text stage were adjudicated by a third reviewer with methodological expertise in sport science reviews. All decisions and exclusion reasons were logged in an audit spreadsheet retained by the review team.

Quality appraisal was conducted independently of the PICOS-based search formulation described in Section 3.2. Each included study was assessed using the Mixed Methods Appraisal Tool (MMAT), version 2018 (Hong et al., 2018), which was selected because it accommodates the heterogeneous quantitative designs anticipated in football fitness research, spanning descriptive, non-randomised and randomised studies within a single appraisal architecture. The procedure comprised three steps. First, each included study was classified into an MMAT design category on the basis of the methodology reported in the abstract and full text. Second, the corresponding five-item MMAT checklist was applied, with each criterion answered yes, no, or cannot tell. Third, no study encountered in this review fell outside the MMAT categories, so no substitution with an alternative appraisal instrument was required; had a purely bibliometric or scoping-type primary study been encountered, the equivalent Joanna Briggs Institute checklist would have been substituted and the substitution noted explicitly.

Table 3. Scoring scheme and quality threshold

Response	Score
Yes (Y)	1.0
Cannot tell or partial (C)	0.5
No (N)	0.0

Studies meeting at least 60 per cent of criteria, equivalent to three of five items, were retained for synthesis without qualification. Studies falling below this threshold were not automatically excluded but were flagged as carrying lower methodological confidence, and their contribution to the synthesis was weighted accordingly in the sensitivity discussion in Section 5.4. No study was excluded from the review on the basis of its quality score alone, consistent with the MMAT developers' guidance against using total scores as an exclusion cutoff (Hong et al., 2018). Appraisal was carried out independently by two reviewers and inter-rater agreement was calculated using Cohen's kappa, which returned a coefficient of 0.84. Following the conventional interpretation of agreement coefficients, this value indicates almost perfect agreement between raters (Landis & Koch, 1977). Residual disagreements concerned the reporting of confounder control in cross-sectional designs and were resolved by consensus. As Table 3 shows, 21 of the 22 included studies met the high-quality threshold and one study was classified as medium quality; the mean appraisal score across the corpus was 4.36 of 5, equivalent to 87.3 per cent.

Table 4. Methodological Quality Appraisal of the 22 Included Studies Using the MMAT (2018)

Author(s), year	MMAT design category	Q1	Q2	Q3	Q4	Q5	Total	%	Quality
Andry et al. (2021)	Quantitative non-randomised	Y	Y	Y	C	Y	4.5	90	High
Chau (2021)	Quantitative non-randomised	Y	Y	C	C	Y	4.0	80	High
Purba & Susanti (2021)	Quantitative descriptive	Y	C	Y	C	Y	4.0	80	High
Komarudin et al. (2022)	Quantitative descriptive	Y	Y	Y	C	Y	4.5	90	High
Madarsa & Mohamad (2022)	Quantitative non-randomised	Y	Y	C	C	Y	4.0	80	High
Chaiyakul & Chaibal (2022)	Quantitative descriptive	Y	Y	Y	Y	Y	5.0	100	High

Author(s), year	MMAT design category	Q1	Q2	Q3	Q4	Q5	Total	%	Quality
Atan et al. (2023)	Quantitative descriptive	Y	Y	Y	C	Y	4.5	90	High
Sanpasitt et al. (2023)	Quantitative descriptive	Y	Y	Y	Y	Y	5.0	100	High
Nuttouch et al. (2023a)	Quantitative descriptive	Y	Y	C	Y	Y	4.5	90	High
Nuttouch et al. (2023b)	Quantitative randomised	Y	Y	Y	C	Y	4.5	90	High
Azhar et al. (2023)	Quantitative non-randomised	Y	Y	Y	C	Y	4.5	90	High
Ahmad et al. (2024)	Quantitative non-randomised	Y	Y	Y	C	C	4.0	80	High
Jatmiko et al. (2024)	Quantitative non-randomised	Y	Y	C	C	Y	4.0	80	High
Jumareng et al. (2024)	Quantitative randomised	Y	Y	Y	C	Y	4.5	90	High
Dewangga et al. (2024)	Quantitative non-randomised	Y	C	Y	C	Y	4.0	80	High
Rosdi et al. (2025)	Quantitative descriptive	Y	Y	Y	Y	Y	5.0	100	High
Kharsynniang (2025)	Quantitative descriptive	Y	Y	C	C	Y	4.0	80	High
Yusni et al. (2025)	Quantitative descriptive	Y	Y	Y	C	Y	4.5	90	High
Norrahmah et al. (2025)	Quantitative non-randomised	Y	Y	Y	C	Y	4.5	90	High
Ahmad et al. (2025)	Quantitative randomised	Y	C	Y	C	Y	4.0	80	High
Hasyim et al. (2025)	Quantitative randomised	Y	Y	Y	Y	Y	5.0	100	High
Saputra & Putra (2025)	Quantitative descriptive	Y	C	C	C	Y	3.5	70	Medium

Note. Y = yes; C = cannot tell or partial; N = no. High quality = 80 per cent or above; medium quality = 60 to 79 per cent; low quality = below 60 per cent. Mean appraisal score = 4.36 of 5 (87.3 per cent); Cohen kappa = 0.84.

A standardised extraction form was piloted on five studies and refined before full application. The following fields were extracted from each included report: first author and publication year; country in which the sample was recruited; competitive level of the players; study design; sample size, sex and age range; the physical fitness components assessed; the specific assessment protocols or instruments applied; any training intervention delivered together with its duration and frequency; the principal outcome measures; and the key findings as reported by the study authors. Extraction was performed by one reviewer and verified in full by a second. Where a study reported outcomes beyond physical fitness, such as technical, psychological or biochemical variables, only the fitness-relevant elements were carried into the synthesis, although the presence of additional outcome domains was recorded because it informs the critical analysis of research design in Section 5.4.

A frequency-based bibliometric description was performed on the included corpus in place of a formal network mapping exercise. Author keywords, assessed fitness components and applied test protocols were extracted from each of the 22 included records and tabulated to produce co-occurrence counts, from which the distributions presented in Figures 5 and 6 were derived. Publication year and country of sample recruitment were tabulated to produce the temporal and geographical distributions in Figures 2 and 3. A software-generated co-authorship or co-citation network was deliberately not produced: with 22 records the resulting maps would have been dominated by single-cluster artefacts and would have conveyed less information than direct frequency reporting. This decision is stated here so that readers do not interpret the absence of a network visualisation as an omission.

All counts reported in Section 5.2 were derived exclusively from the included records themselves. Where a study assessed more than one fitness component or applied more than one protocol, it contributed to each relevant category, so component and protocol counts sum to more than the number of studies. Data were synthesised using thematic synthesis, following the three-stage procedure of line-by-line coding, construction of descriptive themes and generation of analytical themes (Thomas & Harden, 2008). In the first stage, the results and conclusion sections of each included study were coded inductively, generating codes such as aerobic dominance, sprint profiling, positional workload, injury-fitness coupling and protocol substitution. In the second stage, codes were clustered into descriptive themes reflecting patterns visible within the data, namely the range of components assessed, the stratification of samples by competitive standard, and the instrumentation applied.

In the third stage, descriptive themes were interpreted against the three research questions to produce analytical themes that go beyond the primary studies, addressing what the aggregated evidence implies for level-specific profiling in the region. Themes were validated through two procedures: a reviewer who had not participated in coding independently re-coded a random 30 per cent of the corpus and mapped the resulting codes onto the theme structure, and the full theme set was then discussed by the review team until consensus was reached. Discrepancies concerned the boundary between muscular power and anaerobic capacity, which was resolved by classifying single-effort jump outcomes as muscular power and repeated or sustained maximal efforts as anaerobic capacity.

The review was prepared in compliance with the PRISMA 2020 checklist and the PRISMA 2020 flow diagram specification (Page et al., 2021a, 2021b). Every item of the checklist relevant to a review without meta-analysis was addressed within the text, and the flow of records through identification, screening, eligibility and inclusion is reported in Figure 1 with numerically consistent values throughout the abstract, methods and results. A review protocol was not registered prospectively in an international register, and this is acknowledged as a

limitation in Section 5.5. The extraction spreadsheet, screening log and completed appraisal forms are retained by the review team and are available from the corresponding author on reasonable request.

Figure 1 presents the PRISMA 2020 flow diagram for this review, constructed in accordance with the reporting template accompanying the PRISMA 2020 statement (Page et al., 2021a) and its explanation and elaboration document (Page et al., 2021b). The diagram reports four vertical phases. Identification records the 4,122 items retrieved from the database search and the 3,860 items removed before screening, comprising 14 duplicates and 3,846 records eliminated by the interface eligibility filters. Screening records the 262 titles and abstracts assessed, the 197 records excluded at that stage, the 65 reports sought for retrieval and the 12 that could not be obtained. Eligibility records the 53 full-text reports assessed and the 31 excluded with reasons, and Inclusion records the 22 studies carried into the thematic synthesis together with their distribution across competitive levels.

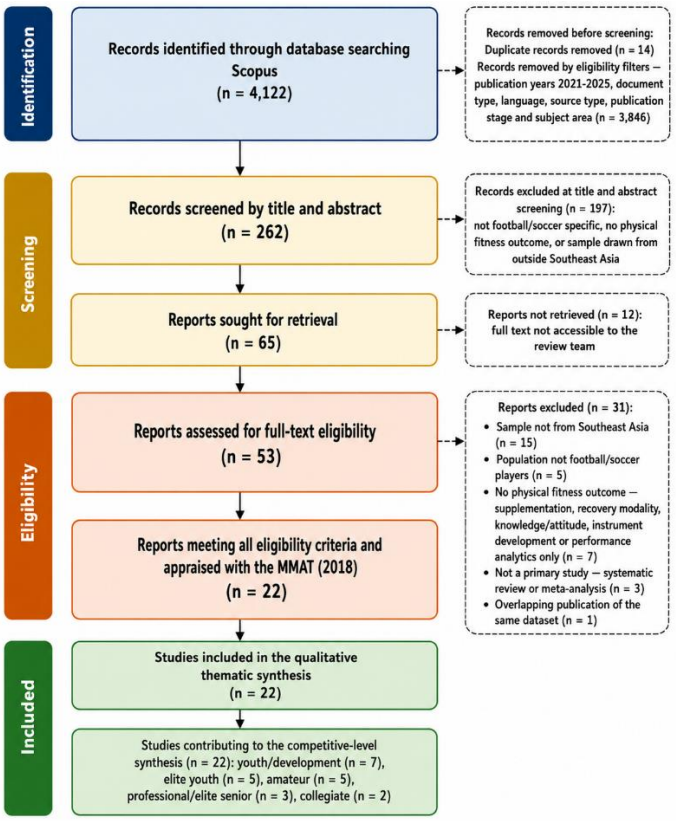

Figure 1. PRISMA 2020 Flow Diagram of the Study Identification, Screening, Eligibility and Inclusion Process

Note. Diagram constructed following the PRISMA 2020 reporting template (Page et al., 2021a, 2021b). All values are derived from the Scopus search executed on 3 August 2026 and are consistent with the counts reported in Sections 3.5 and 5.1.

Results and Discussion

The database search executed in Scopus on 3 August 2026 retrieved 4,122 records. Before screening, 14 duplicate records were removed and a further 3,846 records were eliminated by the interface eligibility filters covering publication year, document type, source type, publication stage and language, leaving 262 records for title and abstract screening. Of these, 197 were excluded because the study was not football specific, reported no physical fitness outcome, or sampled players outside Southeast Asia. Sixty-five reports were sought for retrieval and 12 could not be obtained in full text, so 53 reports proceeded to full-text assessment.

Full-text assessment excluded 31 reports. Fifteen were excluded because the sample was recruited outside Southeast Asia, five because the population was not composed of football players, seven because no physical fitness outcome was reported, three because the report was a systematic review or meta-analysis rather than a primary study, and one because it constituted an overlapping publication of a dataset already represented in the

corpus. Twenty-two studies therefore met all eligibility criteria and were carried into the thematic synthesis. These figures are reported in Figure 1 and are numerically consistent with the values stated in the abstract.

The 22 included studies were published between 2021 and 2025. As Figure 2 shows, output was modest and relatively stable in 2021 and 2022, with three studies in each year, rose to five studies in 2023, moderated to four in 2024, and reached a peak of seven studies in 2025. Almost half of the corpus therefore appeared in the final two years of the review window, indicating an accelerating regional research effort. The 2023 cluster is notable because it contains the only two studies in the corpus that examined senior professional or international players, suggesting that access to elite cohorts became briefly available rather than systematically established.

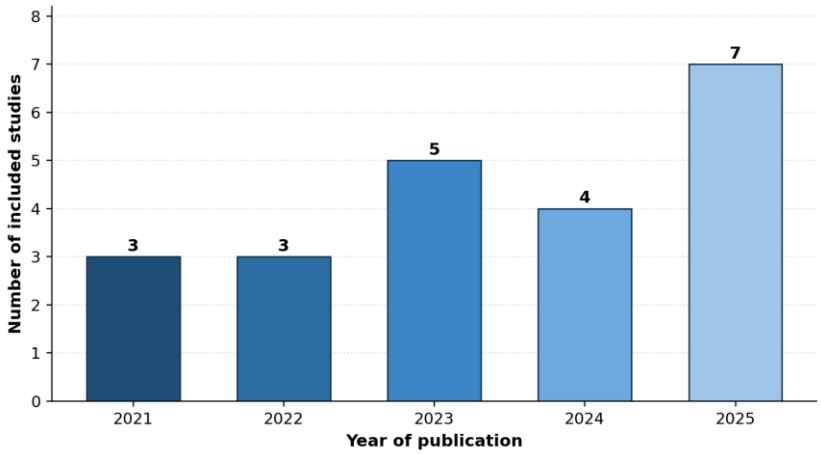

Figure 2. Annual Distribution of the 22 Included Studies, 2021 to 2025

Geographical distribution was markedly uneven. As Figure 3 shows, Indonesia contributed 11 of the 22 studies, equivalent to half the corpus, while Malaysia and Thailand contributed five each and Vietnam contributed one. No eligible study sampled players in the Philippines, Singapore, Brunei Darussalam, Cambodia, Laos, Myanmar or Timor-Leste. The concentration of output in three countries mirrors the distribution of sport science faculties and doctoral programmes in the region rather than the distribution of football participation, and it means that any regional normative statement derived from this literature is in practice an Indonesian, Malaysian and Thai statement.

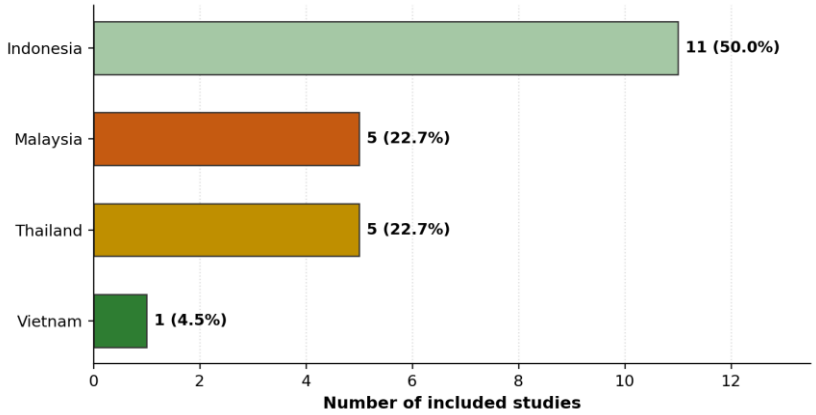

Figure 3. Geographical Distribution of the Included Studies by Country of Sample Recruitment

Competitive level was identifiable in every included study, and the distribution across levels is presented in Figure 4. Seven studies sampled youth or development players, five sampled elite youth cohorts attached to academies or national development programmes, five sampled amateur or recreational players, three sampled professional or elite senior players, and two sampled collegiate players. The evidence base is therefore weighted heavily towards the developmental end of the pathway: 12 of 22 studies examined players below senior age, and only three examined the professional tier that regional performance ambitions ultimately concern. Sex distribution was similarly skewed, with a single study sampling female player exclusively.

Study designs ranged across the quantitative spectrum. Ten studies applied descriptive or correlational cross-sectional designs, eight applied non-randomised experimental or quasi-experimental designs, and four applied

randomised designs. Sample sizes ranged from 20 to 158 participants, with a median close to 35, and intervention durations ranged from four to 24 weeks. Detailed characteristics of every included study, reported with full untruncated titles, full descriptive characteristics are presented in Table 4, and the analytical corresponding classification by competitive level, fitness component and assessment protocol is presented in Table 5, both presented in landscape orientation on the following pages.

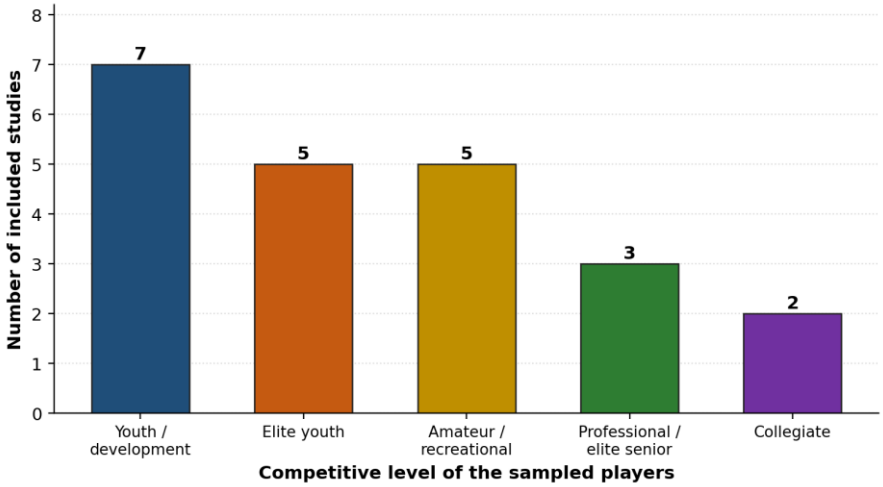

Figure 4. Distribution of the Included Studies Across Competitive Levels

Table 5. Characteristics and Key Findings of the 22 Included Studies

Author(s), year	Country	Competitive level	Design and sample	Full title of the study	Key findings
Andry et al. (2021)	Indonesia	Youth / development (district to national, U-12)	Quasi-experimental, two groups; 46 male players aged 10-12 years; 10 weeks	Effect of 10 weeks game experience learning (GEL) based training on teamwork, respect attitude, skill and physical ability in young football players	Game-experience-learning training produced significantly greater gains in speed, leg power and aerobic endurance than conventional training, alongside improvements in passing, dribbling, teamwork and respect.
Chau (2021)	Vietnam	Youth / development (grassroots U-10)	Longitudinal quasi-experimental; U-10 five-a-side squads; 6 months in three phases, four 90-minute sessions per week	Research on Physical Fitness Development for U10 five-a-side Football Teams	All five fitness tests improved significantly after six months of phased training, with the largest relative gain recorded in the one-minute rope skipping test.
Purba & Susanti (2021)	Indonesia	Collegiate (university junior athletes)	Descriptive cross-sectional survey; male university futsal and football athletes	IMT and VO2max analysis on junior athletes, futsal and football branches: Literature Scopus	Most athletes fell within the normal body mass index band but a substantial minority were overweight or obese, and the majority recorded only moderate to low VO2max, indicating suboptimal aerobic profiles at collegiate level.
Komarudin et al. (2022)	Indonesia	Collegiate (university student football unit)	Correlational cross-sectional; 35 university players	The different influence of speed, agility and aerobic capacity toward soccer skills of youth player	Speed, agility and aerobic capacity each correlated positively with soccer skill performance, with aerobic capacity making the largest contribution among university-level players.

Author(s), year	Country	Competitive level	Design and sample	Full title of the study	Key findings
Madarsa & Mohamad (2022)	Malaysia	Elite youth (state elite youth squad)	Single-group pre-test and post-test; 24 elite youth players; six-week pre-season programme	Profiling the effects of pre-season on cardiovascular and sprinting performance among elite youth football players	A six-week match-specific pre-season programme raised cardiovascular fitness from 58.20 to 67.73 mL/kg/min and improved 20-metre sprint time from 3.16 to 3.09 seconds.
Chaiyakul & Chaibal (2022)	Thailand	Professional / elite senior (six clubs)	Comparative cross-sectional; 40 male professional players in two groups	Physical Performance and Psychological Status of Professional Football Players with Recurrent Ankle Sprains	Players with recurrent ankle sprain showed reduced posteromedial dynamic balance reach only, while weight-bearing lunge, vertical jump and agility did not differ, indicating a selective rather than a global performance deficit.
Atan et al. (2023)	Malaysia	Elite youth (sports school and academy, U-15)	Cross-sectional correlational with match tracking; 20 outfield players; two matches each	Relationship between Match Running Performance and Physical Capacity in Malaysia Young Soccer Players	No significant association emerged between field fitness tests and match running output, indicating that a single physical capacity test is a weak predictor of match performance in young players.
Sanpasitt et al. (2023)	Thailand	Elite youth (U-18 division one club)	Cross-sectional predictive; 90 advanced youth male players across three positions	Anthropometric and Physiological Predictors of Soccer Skills in Youth Soccer Players	Relative maximum anaerobic power, core endurance, countermovement jump and fatigue index predicted passing ability, explaining 29.1 per cent of the variance, while core endurance was the only significant predictor of shooting.
Nuttouch et al. (2023a)	Thailand	Professional / elite senior (national team)	Observational match analysis; national team players across 22 official matches; satellite tracking	Analysis of Positional Differences in the Thai National Football Team Players' Performance Using Global Positioning System Tracking	Forwards covered significantly more high-intensity distance and reached higher sprint and maximum speeds than centre backs, defenders and midfielders, while overall per-match workload was lower than published values for foreign professional cohorts.
Nuttouch et al. (2023b)	Thailand	Professional (second-division league)	Randomised two-arm trial; 30 professional players; eight weeks of onsite versus online delivery	The Effect of an 8-Week Online High-Intensity Interval Training Program on Body Composition and Performance in Thai Professional Football Players During the COVID-19 Epidemic	Body mass, body mass index and fat percentage decreased while fat-free mass, aerobic performance and anaerobic performance improved in both delivery modes, with no significant difference between onsite and online training.
Azhar et al. (2023)	Malaysia	Elite youth (football academy)	Quasi-experimental pre-test and post-test with control;	Impact of ankle taping on dynamic balance and	Ankle taping preserved dynamic balance and single-leg hop

Author(s), year	Country	Competitive level	Design and sample	Full title of the study	Key findings
			elite youth players with chronic ankle instability	functional performance following fatigue simulation in elite youth soccer players with chronic ankle instability	performance after a fatigue-inducing protocol, indicating a protective effect on functional capacity in the later stages of match play.
Ahmad et al. (2024)	Malaysia	Youth / development (competitive youth squads)	Quasi-experimental, two groups; 60 youth players; six weeks	The Effects of Small-Sided Games on Fitness Components and Technical Abilities Among Youth Soccer Players	Six weeks of small-sided games improved speed, aerobic capacity, passing and dribbling relative to control, whereas agility showed no significant between-group change.
Jatmiko et al. (2024)	Indonesia	Youth / development (district squad and academy, 14-17 years)	Pre-test and post-test experimental; 50 athletes; eight weeks, three sessions per week	Increase of VO2 max After 8 Weeks Tuja Shuttle Run Exercise for Athletes in the 14-17 Year Age Group	An eight-week shuttle-run interval protocol produced a significant increase in aerobic capacity measured by the multistage 20-metre shuttle run test.
Jumareng et al. (2024)	Indonesia	Youth / development (17-18 years)	Randomised controlled trial; 24 youth players in two groups; eight weeks	Small Sided Games 3vs3 Goalkeeper-Encouragement: Improve the Physical and Technical Performance of Youth Soccer Players	Small-sided games with goalkeeper encouragement generated significantly greater improvement in sprint, agility and aerobic performance, as well as in dribbling, passing and shooting, than conventional small-sided games.
Dewangga et al. (2024)	Indonesia	Amateur (women's U-17 competition)	Pre-experimental one-group repeated measures; 20 female amateur players; four measurement points	Physical performance and markers of muscle damage response after single soccer matches in amateur women's soccer players	Explosive power declined and muscle damage markers peaked 24 hours after a match before recovering by 48 hours, indicating that amateur female players require at least 48 hours between competitive fixtures.
Rosdi et al. (2025)	Malaysia	Elite youth (national development programme, 13-17 years)	Cross-sectional with cluster analysis; 158 youth footballers	Association between Physical Fitness and Injury Patterns in Young Footballers of the National Football Development Programme in Malaysia	Fitness profiles clustered into a speed-endurance and a power-agility group with distinct injury patterns; faster players carried elevated injury risk across all body regions and the power-agility cluster showed higher knee, foot and ankle risk.
Kharsynniang (2025)	Thailand	Amateur (university, non-athletic)	Cross-sectional survey with stratified random sampling; 113 amateur male university players	Body Composition, Functionality, and Injuries in Football among Amateur Male University Players in Central Thailand	Body composition and functionality were associated with injury occurrence, and the amateur university profile lagged behind professional benchmarks reported elsewhere.
Yusni et al. (2025)	Indonesia	Amateur (18-22 years)	Cross-sectional correlational; 31 male amateur players	The Advantageous Correlation Between Anthropometry and Physical Fitness in Amateur Soccer Players	Amateur players recorded moderate aerobic capacity of 31.47 mL/kg/min with weak speed and agility categories; body weight and body mass index correlated negatively with

Author(s), year	Country	Competitive level	Design and sample	Full title of the study	Key findings
					speed, anaerobic endurance, agility and flexibility, and positively with jump power and muscular endurance.
Norrahmah et al. (2025)	Indonesia	Amateur (young amateur league, about 20 years)	Matched two-group experimental; 36 players; four weeks, three sessions per week	Using Small-Sided Games or Their Combination with Speed Endurance Training: Which Is More Effective for Improving Aerobic Capacity in Young Amateur League Soccer Players?	Both protocols improved aerobic capacity, but small-sided games combined with speed endurance training produced significantly greater increases in total distance covered and estimated VO2max than small-sided games alone.
Ahmad et al. (2025)	Indonesia	Amateur / sub-elite (18-21 years)	Randomised trial; 25 male players in two groups; six weeks	Unveiling anaerobic soccer training: comparing its effects with small-sided games on youth performance enhancement	Anaerobic soccer training and small-sided games both improved aerobic performance, with anaerobic soccer training producing the larger relative gain of 7.23 per cent against 5.06 per cent.
Hasyim et al. (2025)	Indonesia	Youth / development (youth football athletes)	Randomised controlled trial; 78 male youth athletes; 12 weeks, three sessions per week	The Effect of Parkour Activities on Specific Physical Fitness and Grit in the Population of Healthy Youth Football Athletes	Twelve weeks of parkour activity significantly improved sprint, agility and grip strength as well as grit, whereas the control group changed only in isolated measures.
Saputra & Putra (2025)	Indonesia	Youth / development (soccer school)	Correlational; 20 youth players drawn from a squad of 64	Optimizing long passing: a study on the relationship between waist flexibility in soccer players	Trunk flexibility accounted for 72.6 per cent of the variance in long-passing ability, identifying flexibility as an underused but consequential fitness component in youth development.

Note. Titles are reproduced in full as published. Key findings are reported as stated by the study authors and are restricted to the principal outcome of each study.

Table 6. Classification of the Included Studies by Competitive Level, Fitness Component and Assessment Protocol

Author(s), year	Competitive level	Physical fitness components assessed	Assessment protocols applied	Primary outcome focus
Andry et al. (2021)	Youth / development	Speed; muscular power; aerobic endurance	30-metre sprint; vertical jump; multistage fitness test	Training intervention effect
Chau (2021)	Youth / development	Explosive power; speed; speed endurance; aerobic endurance; coordination	Standing long jump; 15-metre sprint; 5 x 30-metre sprints; five-minute run; one-minute rope skipping	Longitudinal fitness development
Purba & Susanti (2021)	Collegiate	Body composition; aerobic capacity	Body mass index; VO2max field estimation	Descriptive fitness profile
Komarudin et al. (2022)	Collegiate	Speed; agility; aerobic endurance	30-metre sprint; five-metre shuttle run; 20-metre beep test	Fitness and skill association
Madarsa & Mohamad (2022)	Elite youth	Cardiovascular fitness; sprint speed	Yo-Yo Intermittent Recovery Test Level 2; 20-metre sprint	Pre-season adaptation
Chaiyakul & Chaibal (2022)	Professional / elite senior	Dynamic balance; ankle mobility; muscular power; agility	Star excursion balance test; weight-bearing lunge; vertical jump; Illinois agility test	Injury-related performance comparison

Atan et al. (2023)	Elite youth	Aerobic capacity; lower-body power; sprint speed	Yo-Yo Intermittent Recovery Test Level 1; countermovement jump; 20-metre sprint; satellite match tracking	Fitness and match performance association
Sanpasitt et al. (2023)	Elite youth	Anthropometry; balance; aerobic capacity; anaerobic power; muscular power; core endurance; agility; speed	Y-balance test; Yo-Yo Intermittent Recovery Test Level 1; running-based anaerobic sprint test; sit-up test; countermovement jump; drop jump; arrowhead agility test; 40-metre sprint	Predictors of technical skill
Nuttouch et al. (2023a)	Professional / elite senior	Locomotor capacity; sprint speed	Satellite match tracking across 22 matches	Positional workload profile
Nuttouch et al. (2023b)	Professional / elite senior	Body composition; aerobic performance; anaerobic performance	Body composition assessment; aerobic and anaerobic performance testing	Training delivery mode comparison
Azhar et al. (2023)	Elite youth	Dynamic balance; functional performance	Y-balance test; single-leg hop test after a fatigue protocol	Functional capacity under fatigue
Ahmad et al. (2024)	Youth / development	Speed; agility; cardiovascular endurance	Sprint test; agility test; VO2max field test	Training intervention effect
Jatmiko et al. (2024)	Youth / development	Aerobic capacity	Multistage 20-metre shuttle run test	Training intervention effect
Jumareng et al. (2024)	Youth / development	Speed; agility; aerobic endurance	20-metre sprint; Illinois agility test; multistage 20-metre fitness test	Training intervention effect
Dewangga et al. (2024)	Amateur	Muscular power; body composition context	Vertical jump with repeated post-match measurement	Match-induced fatigue and recovery
Rosdi et al. (2025)	Elite youth	Cardiorespiratory fitness; speed; agility; explosive power	VO2max estimation; 5, 10 and 20-metre sprints; arrowhead agility test; countermovement jump	Fitness clusters and injury patterns
Kharsynniang (2025)	Amateur	Body composition; functional capacity	Body composition indices; functionality assessment	Descriptive fitness profile and injury
Yusni et al. (2025)	Amateur	Speed; muscular power; muscular endurance; anaerobic endurance; agility; flexibility; aerobic capacity; anthropometry	Sprint test; jump test; sit-up test; anaerobic endurance test; agility test; sit-and-reach test; aerobic capacity test; body mass index	Descriptive fitness profile
Norrahmah et al. (2025)	Amateur	Aerobic capacity	Yo-Yo Intermittent Recovery Test Level 1 (total distance and estimated VO2max)	Training intervention comparison
Ahmad et al. (2025)	Amateur / sub-elite	Aerobic capacity; anaerobic power; fatigue resistance	2400-metre run; anaerobic power indices; fatigue index	Training intervention comparison
Hasyim et al. (2025)	Youth / development	Speed; agility; grip strength	30-metre sprint; Illinois agility test; hand-grip dynamometry	Training intervention effect
Saputra & Putra (2025)	Youth / development	Flexibility	Sit-and-reach test; long-passing accuracy test	Fitness and skill association

Note. Studies assessing more than one component or applying more than one protocol contribute to each relevant category, so category counts reported in Section 5.3 exceed the number of studies.

The synthesis is organised around the three research questions. Each subsection aggregates evidence across studies rather than reporting them sequentially, and identifies agreements, contradictions and boundary conditions within the corpus.

Findings for RQ1: Physical Fitness Components Assessed

Across the corpus, nine distinct physical fitness components were assessed, and their distribution is heavily skewed. As Figure 5 shows, aerobic capacity or cardiorespiratory endurance was assessed in 15 of the 22 studies, making it the dominant construct in Southeast Asian football fitness research. Linear speed followed in 8 studies, and agility together with muscular power appeared in eight studies each. Beyond this quartet, coverage thinned sharply: body composition or anthropometry featured in five studies, anaerobic capacity in four, muscular strength or endurance in three, dynamic balance in three, and flexibility in only two. The aggregate picture is of

a research culture organised around endurance and speed, with the remaining components treated as optional additions rather than as constitutive elements of a football fitness profile.

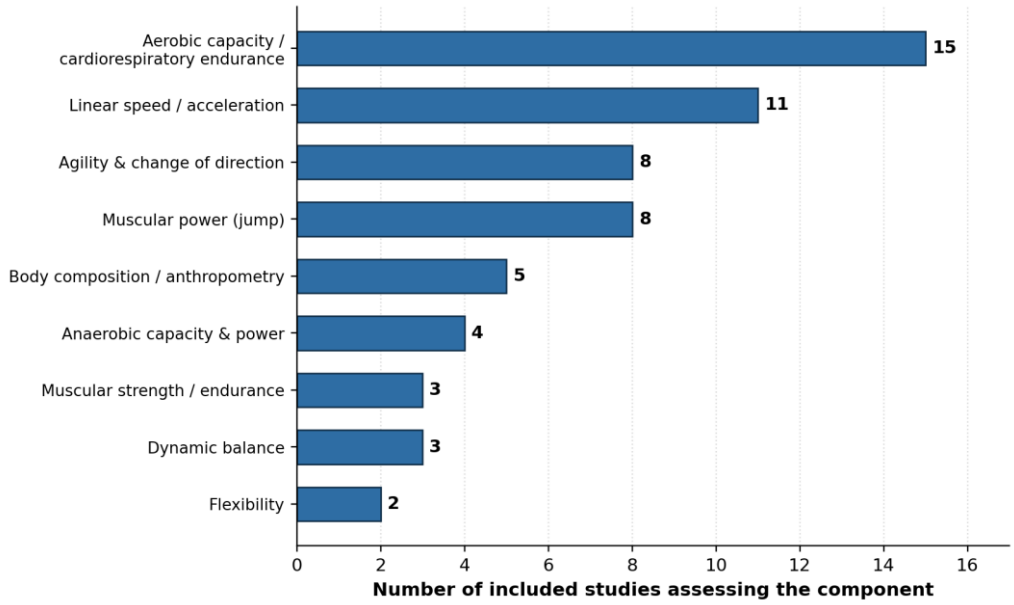

Figure 5. Frequency of Physical Fitness Components Assessed Across the 22 Included Studies

The dominance of aerobic testing is defensible on the grounds of match demand, and the studies that examined it converge on the finding that aerobic capacity is trainable within short cycles across every level sampled. Structured programmes lasting four to twelve weeks improved aerobic outcomes in youth academy players (Jatmiko et al., 2024), amateur league players (Norrahmah et al., 2025; Ahmad et al., 2025), competitive youth squads (Ahmad et al., 2024; Jumareng et al., 2024), elite youth players (Madarsa & Mohamad, 2022) and professional players (Nuttouch et al., 2023b). Yet the concentration on a single component obscures the multidimensionality that the more comprehensive studies in the corpus reveal. Where broad batteries were applied, distinct components behaved independently: relative anaerobic power, core endurance and jump performance predicted passing ability while aerobic capacity did not (Sanpasitt et al., 2023), and speed-endurance and power-agility profiles separated into distinct clusters with different injury consequences (Rosdi et al., 2025).

The neglected components are consequential rather than peripheral. Flexibility was assessed in only two studies, yet in one of them trunk flexibility accounted for 72.6 per cent of the variance in long-passing ability among youth players (Saputra & Putra, 2025), and in the other it formed part of a profile in which amateur players were categorised as adequate on flexibility but weak on speed and agility (Yusni et al., 2025). Dynamic balance appeared in three studies, all of them motivated by injury rather than by performance profiling (Azhar et al., 2023; Chaiyakul & Chaibal, 2022; Sanpasitt et al., 2023). Anaerobic capacity, arguably the quality most closely tied to decisive match actions, was quantified in four studies only (Ahmad et al., 2025; Nuttouch et al., 2023b; Sanpasitt et al., 2023; Yusni et al., 2025). In answer to RQ1, the components assessed in the region cluster tightly around aerobic capacity, speed, agility and power, while flexibility, balance, anaerobic capacity and muscular strength remain substantially under-assessed.

Findings for RQ2: Fitness Characteristics Across Competitive Levels

Stratifying the corpus by competitive level reveals that the tiers are not merely different in the fitness values reported but different in what is asked of the evidence. At the youth and development level, which contributed seven studies, research is overwhelmingly interventional and oriented towards demonstrating that a training format works. Game-based learning, small-sided games, shuttle-run intervals, goalkeeper-encouraged small-sided formats and parkour activity all produced significant improvements in speed, power and aerobic endurance in samples aged from 10 to 18 years (Andry et al., 2021; Ahmad et al., 2024; Hasyim et al., 2025; Jatmiko et al., 2024; Jumareng et al., 2024), and phased longitudinal conditioning produced across-the-board gains in a grassroots U-10 cohort (Chau, 2021). The characteristic finding at this level is malleability: almost any structured stimulus improves almost any measured quality, which limits the discriminative value of the outcomes.

The elite youth tier, contributing five studies, shifts towards profiling and prediction. Here the evidence becomes more analytically demanding and, notably, more sceptical. Field fitness tests failed to predict match

running output in a Malaysian academy cohort, leading the authors to caution against using single capacity tests for talent identification (Atan et al., 2023). Comprehensive testing of a Thai U-18 division one squad showed that only specific qualities, namely relative anaerobic power and core endurance, predicted technical execution (Sanpasitt et al., 2023). Cluster analysis of a Malaysian national development programme found that superior speed was associated with higher, not lower, injury incidence (Rosdi et al., 2025). Pre-season conditioning nevertheless produced substantial aerobic and sprint improvement in an elite youth squad (Madarsa & Mohamad, 2022), and taping preserved balance and hop performance under fatigue in academy players with ankle instability (Azhar et al., 2023). The elite youth literature thus treats fitness as a diagnostic construct whose relationship to performance is contingent.

The amateur, collegiate and professional tiers present a third pattern. Amateur and collegiate profiles, drawn from five and two studies respectively, are consistently modest: moderate to low aerobic capacity and weak speed and agility categories among amateur players aged 18 to 22 (Yusni et al., 2025), predominantly normal body mass index but mediocre VO2max among university athletes (Purba & Susanti, 2021), body composition linked to injury among non-athletic university players (Kharsynniang, 2025), and delayed recovery requiring at least 48 hours between fixtures in amateur women (Dewangga et al., 2024). At the professional tier, contributed by three studies, the evidence turns to workload and injury rather than to development: positional analysis showed forwards accumulating the greatest high-intensity distance while whole-team output remained below foreign professional benchmarks (Nuttouch et al., 2023a), interval training improved body composition and both aerobic and anaerobic performance irrespective of delivery mode (Nuttouch et al., 2023b), and recurrent ankle sprain produced only a selective balance deficit rather than a global impairment (Chaiyakul & Chaibal, 2022). In answer to RQ2, the corpus indicates a graded regional profile in which trainability dominates at youth level, contingency and diagnostic scepticism dominate at elite youth level, and workload management with modest absolute values characterises the amateur and professional tiers; but because no single study compared levels directly, this gradient is a synthesis-level inference rather than a demonstrated effect.

Findings for RQ3: Assessment Protocols and Testing Methods

The assessment protocols applied across the corpus are summarised in Figure 6 and detailed for each study in Table 5. Linear sprint testing over distances from 5 to 40 metres was the most frequently applied protocol, appearing in eight studies, followed by countermovement or vertical jump testing in five studies. Aerobic assessment was split almost evenly between two non-interchangeable families: the Yo-Yo Intermittent Recovery Test at Level 1 or Level 2 in four studies, and the multistage 20-metre shuttle run or beep test in four studies. Body composition and anthropometric indices appeared in four studies, the Illinois agility test in three, Y-balance or star excursion balance testing in three, satellite match tracking in two, the arrowhead agility test in two, and the sit-and-reach flexibility test in two.

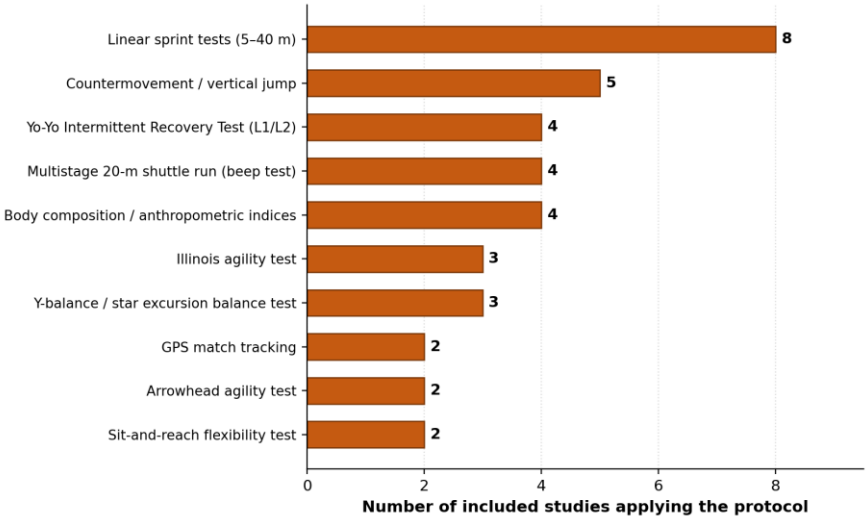

Figure 6. Ten Most Frequently Applied Physical Fitness Assessment Protocols Across the Included Studies

This distribution carries a methodological warning. The two dominant aerobic protocols yield systematically different estimates of the same underlying construct, because the Yo-Yo test imposes intermittent shuttle running with recovery intervals that approximate match demands while the multistage shuttle run imposes progressive continuous running. Studies reporting VO2max derived from these different protocols cannot be pooled or benchmarked against one another without conversion, yet several regional reports present estimated VO2max as though it were protocol-independent (Jatmiko et al., 2024; Purba & Susanti, 2021; Yusni et al., 2025). A

comparable problem affects agility, where the Illinois test and the arrowhead test load change-of-direction mechanics differently, and speed, where sprint distances ranged from 5 to 40 metres across the corpus and therefore indexed acceleration and maximum velocity to varying degrees.

Instrumentation also stratifies by competitive level in a way that constrains cross-level comparison. Satellite match tracking, the only method that measures fitness expression in competition rather than capacity in isolation, was applied in just two studies, both attached to elite cohorts (Atan et al., 2023; Nuttouch et al., 2023a). Laboratory-grade or clinically validated instruments such as the Y-balance test and running-based anaerobic sprint testing appeared almost exclusively in elite youth and professional samples (Azhar et al., 2023; Chaiyakul & Chaibal, 2022; Sanpasitt et al., 2023), whereas youth and amateur studies relied on low-cost field tests requiring minimal equipment. In answer to RQ3, sprint tests, jump tests and the two competing aerobic shuttle protocols constitute the de facto regional testing battery, but their application is neither standardised across studies nor equitably distributed across competitive levels.

Comparative and Critical Analysis

Methodologically, the corpus is dominated by short-horizon designs. Ten of the 22 studies were cross-sectional, capturing a single snapshot of capacity, and of the 12 studies with an intervention, none extended beyond 24 weeks and most ran for six to twelve weeks. Only four studies used randomisation (Ahmad et al., 2025; Hasyim et al., 2025; Jumareng et al., 2024; Nuttouch et al., 2023b), and several intervention studies used single-group pre-test and post-test designs without any comparator (Chau, 2021; Madarsa & Mohamad, 2022), which leaves maturation, seasonal phase and repeated-testing effects unaccounted for. Sample sizes were generally small, with a median close to 35 participants and only two studies exceeding 100, so the corpus is systematically vulnerable to type II error in the components with modest expected effect sizes.

Design choice also tracks competitive level in an informative way. Interventional designs concentrate at the youth and amateur tiers where researchers control the training environment, while descriptive and observational designs concentrate at the elite youth and professional tiers where access is negotiated rather than granted. This division has an epistemic cost: the levels where causal evidence would be most valuable for performance decision-making are precisely those where causal designs are least often achievable. The two studies applying satellite tracking illustrate the point, since both were observational by necessity (Atan et al., 2023; Nuttouch et al., 2023a).

A methodological evolution is nonetheless discernible across the review window. The 2021 and 2022 studies are predominantly single-outcome or narrow-battery investigations (Andry et al., 2021; Chau, 2021; Komarudin et al., 2022; Purba & Susanti, 2021), whereas the 2023 to 2025 studies more frequently apply multi-component batteries, cluster or regression-based analysis, and injury-linked interpretation (Rosdi et al., 2025; Sanpasitt et al., 2023; Yusni et al., 2025). Analytical sophistication is therefore increasing even where design rigour is not. On sensitivity, the single study appraised as medium quality (Saputra & Putra, 2025) contributes the corpus's strongest claim about flexibility; removing it would not alter the conclusion that flexibility is under-assessed, but it would remove the principal evidence that flexibility matters, so that specific claim is reported here as suggestive rather than established.

Interpretation of findings

The synthesis indicates that physical fitness research on Southeast Asian football is abundant in volume but narrow in construct coverage and shallow in cross-level integration. Theoretically, the results are consistent with a multidimensional rather than a unitary conception of football fitness: where broad batteries were applied, components dissociated, with anaerobic power and core endurance predicting technical execution while aerobic capacity did not (Sanpasitt et al., 2023), and with speed and power qualities separating into clusters carrying distinct injury profiles (Rosdi et al., 2025). The finding that field capacity tests failed to predict match running output in academy players (Atan et al., 2023) reinforces the distinction between capacity, which tests measure, and expression, which competition reveals, and cautions against treating the two as interchangeable in talent identification.

Theoretical implications

Theoretically, three implications follow. First, the capacity-expression distinction requires explicit modelling in regional talent frameworks; a battery that predicts nothing about match output is a physiological description rather than a selection instrument. Second, the level-graded pattern documented in Section 5.3.2 suggests that the relationship between fitness and performance is moderated by competitive standard, so that trainability dominates where the training age is low and specificity dominates where it is high. This is congruent with intervention evidence from outside the region showing that specialised stimuli such as plyometric loading and speed-agility-quickness training yield larger returns in trained than in untrained cohorts (Deng et al., 2023; Firmansyah et al., 2024; Sun et al., 2025). Third, the injury findings challenge a simple more-is-better model of

fitness: superior speed was associated with elevated injury risk (Rosdi et al., 2025), and recurrent injury produced only a selective balance deficit rather than global impairment (Chaiyakul & Chaibal, 2022), implying that fitness and robustness are partially independent constructs.

Practical implications

For practitioners, four actionable implications emerge. Coaches working at youth level can expect broad responsiveness to almost any structured stimulus and should therefore select formats on the basis of technical and motivational co-benefits rather than physiological return alone, since small-sided and game-based formats improved fitness while simultaneously improving passing, dribbling and teamwork (Ahmad et al., 2024; Andry et al., 2021; Jumareng et al., 2024). Practitioners at elite youth level should replace single-test screening with multi-component batteries that include anaerobic power, core endurance and change-of-direction capacity, given the demonstrated failure of isolated tests to predict either match output or technical execution (Atan et al., 2023; Sanpasitt et al., 2023). Amateur and collegiate programmes should treat body composition as a primary rather than an incidental target, since it correlated with fitness decrements and injury in both Indonesian and Thai samples (Kharsynniang, 2025; Yusni et al., 2025). Finally, scheduling at amateur level should respect a minimum 48-hour inter-match interval, the recovery window identified in the only female cohort in the corpus (Dewangga et al., 2024).

Comparison with prior reviews

Situating these findings against prior reviews is instructive. Existing syntheses in this domain are intervention-focused and geographically unrestricted: reviews of plyometric training and of speed-agility-quickness training pool international evidence to establish average effects on power and technical outcomes (Deng et al., 2023; Firmansyah et al., 2024; Sun et al., 2025). Those reviews answer whether a method works; the present review answers what has been measured, in whom, and with which instruments within one region. The distinction matters because the intervention literature implicitly assumes a comparable baseline across contexts, whereas the regional evidence assembled here shows absolute values that fall below foreign professional benchmarks (Nuttouch et al., 2023a) and amateur profiles categorised as weak on several components (Yusni et al., 2025). No previous review has stratified football fitness evidence by competitive level within Southeast Asia, and this level-stratified map is the principal contribution of the present work.

Contradictions in the literature

Several contradictions warrant explicit attention. The most direct concerns agility: six weeks of small-sided games improved speed and aerobic capacity but left agility unchanged in a Malaysian youth cohort (Ahmad et al., 2024), whereas parkour activity improved agility substantially in an Indonesian youth cohort over twelve weeks (Hasyim et al., 2025). Duration, stimulus specificity and differing agility protocols plausibly explain the divergence, since change-of-direction adaptation appears to require longer exposure and more direction-specific loading than generalised game play. A second contradiction concerns the value of aerobic capacity: it emerged as the largest contributor to skill among collegiate players (Komarudin et al., 2022) but failed to predict passing or shooting among elite youth players (Sanpasitt et al., 2023), a discrepancy consistent with aerobic capacity acting as a threshold rather than a linear determinant once a competitive standard is reached. A third concerns the relationship between fitness and injury, where higher speed predicted greater injury incidence (Rosdi et al., 2025) while superior functional capacity was protective under fatigue (Azhar et al., 2023), indicating that different fitness qualities carry opposing risk signatures.

Comparable tensions surround the transfer of findings across populations. Evidence from adjacent groups in the region, including referees, para-athletes and players of other invasion sports (Jakiwa et al., 2023; Mudian et al., 2021; Sukriadi et al., 2023; Tajudin et al., 2022), suggests that generic conditioning transfers unevenly, while intervention work in female and collegiate cohorts elsewhere reports effects broadly consistent with those observed regionally (Deep et al., 2025; Panascì et al., 2025; Prasad et al., 2025; Quan et al., 2024). The absence of regional replication in female and professional samples makes it impossible to determine whether these convergences reflect genuine generalisability or the coincidence of similar protocols applied to dissimilar populations.

Research gaps

Six research gaps follow directly from the synthesis. The first is the absence of any study that compares two or more competitive levels within a single design and protocol, which means the level gradient described in Section 5.3.2 remains inferential. The second is the near-total absence of female players, represented by one study in 22 (Dewangga et al., 2024), leaving half the regional playing population without normative reference values. The third is the scarcity of professional and international cohorts, represented by three studies, and the complete absence of longitudinal tracking through the transition from academy to senior football. The fourth is protocol fragmentation, particularly the unreconciled coexistence of two aerobic testing families, which prevents the construction of a pooled regional normative database. The fifth is geographical: seven of the eleven Southeast

Asian nations contributed no eligible study. The sixth is the imbalance between intervention and profiling research, with regionally produced work frequently diverted towards supplementation, passive recovery and biochemical outcomes rather than fitness characterisation itself (Adji et al., 2022; Fajar et al., 2025; Mulyawan et al., 2023; Welis & Mario, 2023).

Limitations of this review

Five limitations qualify these conclusions. First, only one database was searched. Scopus indexes the regional outlets in which this literature predominantly appears, but restricting identification to a single source will have missed eligible work indexed elsewhere or published in national journals outside international indexing, and no citation chasing or grey literature search was undertaken. Second, the English-language restriction systematically excludes research published in Bahasa Indonesia, Bahasa Melayu, Thai and Vietnamese, which is likely to bias the corpus towards internationally oriented research groups and away from domestic practice. Third, twelve reports could not be retrieved in full text, and their exclusion is a function of institutional access rather than of eligibility. Fourth, the review was not prospectively registered, so protocol deviations cannot be independently audited. Fifth, competitive level was assigned by the review team on the basis of sampling descriptions rather than through a standardised classification instrument; terms such as elite, amateur and youth are used inconsistently in the primary literature, and although classification was verified by two reviewers, some assignments necessarily involved judgement. Additionally, because quantitative pooling was not possible, the level gradient reported here rests on narrative comparison and should not be read as an effect size.

Future research agenda

Five concrete recommendations follow. First, a multi-site cross-level study should be conducted in which an identical battery, comprising the Yo-Yo Intermittent Recovery Test Level 1, 10 and 30-metre sprints, countermovement jump, a change-of-direction test and body composition assessment, is administered to youth, elite youth, amateur and professional squads within the same country and season, so that the inferred level gradient can be tested directly. Second, a regional normative database should be established under the coordination of a regional federation or university consortium, with mandatory protocol reporting and a published conversion procedure for the two aerobic testing families. Third, a dedicated programme of research on female football players should be commissioned across at least three countries, prioritising baseline profiling, match load and recovery kinetics, since the single available regional study addresses only the last of these (Dewangga et al., 2024). Fourth, longitudinal cohort tracking of academy players over a minimum of three seasons should be initiated to capture the maturation-adjusted development of fitness qualities and their relationship to selection outcomes and injury. Fifth, future intervention research should routinely include a fitness-expression outcome measured in competition, whether through satellite tracking or validated match observation, so that capacity gains can be shown to transfer to the environment in which they are supposed to matter (Atan et al., 2023; Nuttouch et al., 2023a).

Summary answers to the research questions

In direct answer to the research questions, the following summary applies. RQ1: nine physical fitness components have been assessed in Southeast Asian football research between 2021 and 2025, dominated by aerobic capacity in 15 of 8 studies and linear speed in 11, with agility and muscular power in eight each, and with flexibility, dynamic balance, anaerobic capacity and muscular strength substantially under-assessed. RQ2: the reported profiles differ across competitive levels in kind as much as in magnitude, with youth and development players characterised by broad trainability, elite youth players by contingent and diagnostically sceptical relationships between capacity and performance, amateur and collegiate players by modest absolute values coupled with body composition and recovery concerns, and professional players by workload and injury management against benchmarks below international reference values; because no included study compared levels within a single design, this gradient is an inference drawn across studies. RQ3: linear sprint tests, countermovement or vertical jump tests, and two competing aerobic shuttle protocols, the Yo-Yo Intermittent Recovery Test and the multistage 20-metre shuttle run, constitute the region's de facto testing battery, applied with substantial variation in distance, protocol version and instrumentation across competitive levels.

Conclusion

This review mapped 22 studies published between 2021 and 2025 on the physical fitness of football players sampled in Southeast Asia. Nine fitness components have been assessed, but the evidence concentrates on aerobic capacity, linear speed, agility and muscular power, while flexibility, dynamic balance and anaerobic capacity remain marginal. Profiles differ across competitive levels in character rather than merely in magnitude, moving from broad trainability at youth level, through contingent capacity-performance relationships at elite youth level, to workload and injury management at professional level, where absolute values sit below international benchmarks. Sprint tests, jump tests and two non-interchangeable aerobic shuttle protocols form

the de facto regional battery. The principal contribution is the first level-stratified evidence map for football fitness in this region, which supports level-specific testing and a harmonised normative database. Single-database and English-language restrictions, the near-absence of female and professional cohorts, and the absence of within-study level comparison qualify these conclusions and define the priorities for future regional research.

References

Adji, F. R., Sofro, Z. M., & Hapsari, M. (2022). The effect of beetroot juice (Beta vulgaris L.) supplementation on VO2max of youth soccer athletes. Journal of Public Health in Africa, 13(s2), Article 2406. https://doi.org/10.4081/jphia.2022.2406

Ahmad, M. F., Low, J. F. L., & Nadzalan, A. M. (2024). The effects of small-sided games on fitness components and technical abilities among youth soccer players. Central European Journal of Sport Sciences and Medicine, 45(1), 83-93. https://doi.org/10.18276/cej.2024.1-07

Ahmad, T. H. M., Kusuma, I. D. M. A. W., Pramono, B. A., Ramadani, M. I., & Nirwansyah, W. T. (2025). Unveiling anaerobic soccer training: Comparing its effects with small-sided games on youth performance enhancement. Pedagogy of Physical Culture and Sports, 29(3), 150-159. https://doi.org/10.15561/26649837.2025.0301

Alexe, D. I., Causevic, D., Covic, N., Rani, B., Tohanean, D. I., Abazovic, E., Setiawan, E., & Alexe, C. I. (2024). The relationship between functional movement quality and speed, agility, and jump performance in elite female youth football players. Sports, 12(8), Article 214. https://doi.org/10.3390/sports12080214

Andry, A., Nawan, P., Fatkurahman, A., Nurhadi, S., & Dewangga, Y. (2021). Effect of 10 weeks game experience learning (GEL) based training on teamwork, respect attitude, skill and physical ability in young football players. Physical Education Theory and Methodology, 21(2), 173-179. https://doi.org/10.17309/tmfv.2021.2.11

Atan, S. A., Azli, M. S., Jakiwa, J., & Rustam, S. (2023). Relationship between match running performance and physical capacity in Malaysia young soccer players. Sport Mont, 21(1), 55-59. https://doi.org/10.26773/smj.230209

Azhar, N. I., Manaf, H., Kamsan, S. S., Lo, C. N., Justine, M., & Bukry, S. A. (2023). Impact of ankle taping on dynamic balance and functional performance following fatigue simulation in elite youth soccer players with chronic ankle instability. Journal of Physical Education and Sport, 23(10), 2610-2619. https://doi.org/10.7752/jpes.2023.10299

Carvalho, T., Rago, V., Brito, J., Praxedes, P., Abreu, M., Silva, D., Pereira, S., Mohr, M., Baptista, I., & Afonso, J. (2025). Physical and physiological demands of official beach soccer match-play in relation to environmental temperature. Sports, 13(4), Article 118. https://doi.org/10.3390/sports13040118

Chainok, P., Abdul, D. R., Pizarro, A. I. N., Barreira, J., Ribeiro, J. C., Santos, M. P., dos Santos, J. A. R., Ribeiro, J., & Zacca, R. (2025). How do the physical and physiological demands of training and official football match for recreational players compare to those of semi-professionals? Frontiers in Sports and Active Living, 7, Article 1553694. https://doi.org/10.3389/fspor.2025.1553694

Chaiyakul, S., & Chaibal, S. (2022). Physical performance and psychological status of professional football players with recurrent ankle sprains. Sport Mont, 20(2), 3-8. https://doi.org/10.26773/smj.220603

Chau, V. H. (2021). Research on physical fitness development for U10 five-a-side football teams. Open Sports Sciences Journal, 14(1), 92-97. https://doi.org/10.2174/1875399X02114010092

Deep, P., Manamkandath, M. P., Asaraf, R. K., Dalipe, M. A., Astuti, Y., Prasad, B., Saha, S., & Mondal, P. (2025). Eight-week intervention of small-sided games with high-intensity interval training versus traditional HIIT on the physical fitness of soccer players. International Journal of Kinesiology and Sports Science, 13(4), 121-130. https://doi.org/10.7575/aiac.ijkss.v.13n.4p.121

Deng, N., Soh, K. G., Abdullah, B., Huang, D., Xiao, W., & Liu, H. (2023). Effects of plyometric training on technical skill performance among athletes: A systematic review and meta-analysis. PLOS ONE, 18(7), Article e0288340. https://doi.org/10.1371/journal.pone.0288340

Dewangga, M. W., Susilo, T. E., Cahyadi, M. M., Saputra, H., Furqony, I. Y., Putra, Z. Y., Wilger, R. V., Medistianto, T. N. R., Candrika, A. A., & Rosyid, F. N. (2024). Physical performance and markers of muscle damage response after single soccer matches in amateur women's soccer players. Fizjoterapia Polska, 2024(2), 136-143. https://doi.org/10.56984/8ZG5608X8S

Fajar, M. K., Hariyanto, A., Wahjuni, E. S., Kartiko, D. C., Siantoro, G., Phanpheng, Y., Kusuma, I. D. M. A. W., Pramono, B. A., Rusdiawan, A., & Pranoto, A. (2025). Determining the efficacy of providing ice compression for fitness enhancement after speed endurance exercise on reducing heart rate, IL-6, and fatigue index in football athletes. Physical Education Theory and Methodology, 25(1), 58-65. https://doi.org/10.17309/tmfv.2025.1.07

Firmansyah, A., Prasetya, M. R. A., Al Ardha, M. A., Ayubi, N., Putro, A. B., Mutohir, T. C., Garcia Jimenez, J. V., & Hanief, Y. N. (2024). The football players on plyometric exercise: A systematic review. Retos, 51, 442-448. https://doi.org/10.47197/retos.v51.100800

Hasyim, H., Hakim, H., Kasmad, M. R., Ramli, R., Setiawan, I., Kurtoglu, A., Govindasamy, K., Lobo, J., Poblete-Valderrama, F., & Setiawan, E. (2025). The effect of parkour activities on specific physical fitness and grit in the population of healthy youth football athletes. Journal of Population and Social Studies, 33, 491-506. https://doi.org/10.25133/JPSSV332025.026

Hong, Q. N., Pluye, P., Fabregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M.-P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M.-C., & Vedel, I. (2018). Mixed Methods Appraisal Tool (MMAT), version 2018 (Registration of Copyright No. 1148552). Canadian Intellectual Property Office, Industry Canada.

Jakiwa, J., Rustam, S., Atan, S. A., Azli, M. S., Maliki, A. B. H. M., Nadzmi, A., Rahman, A. F. A., Samsir, M. S., Sun, Z., Kuo, P. T., & Bee, N. C. T. S. (2023). The effects of multi-sport intervention on agility performance among young athletes. International Journal of Human Movement and Sports Sciences, 11(4), 864-871. https://doi.org/10.13189/saj.2023.110421

Jatmiko, T., Kusnanik, N. W., Nurhasan, N., Muhammad, H. N., & Purwoto, S. P. (2024). Increase of VO2 max after 8 weeks Tuja shuttle run exercise for athletes in the 14-17 year age group. Retos, 55, 575-580. https://doi.org/10.47197/retos.v55.103973

Jia, Z., Abdullah, B. B., Omar Dev, R. D., & Samsudin, S. B. (2021). Influence of football basic technical training on youth soccer players in Shanxi province, China. Cypriot Journal of Educational Sciences, 16(2), 777-788. https://doi.org/10.18844/cjes.v16i2.5658

Jumareng, H., Setiawan, E., Tannoubi, A., Lardika, R. A., Adil, A., Gazali, N., Gani, R. A., Ahmedov, F., Kurtoglu, A., & Alexe, D. I. (2024). Small sided games 3vs3 goalkeeper-encouragement: Improve the physical and technical performance of youth soccer players. European Journal of Human Movement, 52, 129-140. https://doi.org/10.21134/eurjhm.2024.52.11

Kharsynniang, H. (2025). Body composition, functionality, and injuries in football among amateur male university players in Central Thailand. Human Behavior, Development and Society, 26(3), 558-570. https://doi.org/10.62370/hbds.v26i3.282220

Komarudin, K., Suharjana, S., Yudanto, Y., & Kusuma, M. N. H. (2022). The different influence of speed, agility and aerobic capacity toward soccer skills of youth player. Pedagogy of Physical Culture and Sports, 26(6), 381-390. https://doi.org/10.15561/26649837.2022.0604

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. Biometrics, 33(1), 159-174. https://doi.org/10.2307/2529310

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gotzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. PLoS Medicine, 6(7), Article e1000100. https://doi.org/10.1371/journal.pmed.1000100

Liu, G., Wang, X., & Xu, Q. (2024a). Microdosing plyometric training enhances jumping performance, reactive strength index, and acceleration among youth soccer players: A randomized controlled study design. Journal of Sports Science and Medicine, 23(2), 342-350. https://doi.org/10.52082/jssm.2024.342

Liu, G., Wang, X., & Xu, Q. (2024b). Supervised offseason training programs are able to mitigate the effects of detraining in youth men soccer players physical fitness: A randomized parallel controlled study. Journal of Sports Science and Medicine, 23(1), 219-227. https://doi.org/10.52082/jssm.2024.219

Madarsa, N. I., & Mohamad, N. I. (2022). Profiling the effects of pre-season on cardiovascular and sprinting performance among elite youth football players. Journal of Physical Education and Sport, 22(11), 2676-2680. https://doi.org/10.7752/jpes.2022.11340

Methley, A. M., Campbell, S., Chew-Graham, C., McNally, R., & Cheraghi-Sohi, S. (2014). PICO, PICOS and SPIDER: A comparison study of specificity and sensitivity in three search tools for qualitative systematic reviews. BMC Health Services Research, 14, Article 579. https://doi.org/10.1186/s12913-014-0579-0

Mudian, D., Asmawi, M., Rihatno, T., Lanos, M. E. C., Elisyah, V., & Aji, T. (2021). Trend improving soccer professional referees performance in West Java using psychological skill training and physical fitness. International Journal of Human Movement and Sports Sciences, 9(3), 595-601. https://doi.org/10.13189/saj.2021.090328

Mulyawan, R., Nugroho, S., Syafriani, R., Dev, R. D. O., & Kurniawan, D. D. (2023). Short-term effects of milk (both unpasteurized and pasteurized) on active adolescence hemoglobin. Fizjoterapia Polska, 23(2), 12-18. https://doi.org/10.56984/8ZG0DF232

Norrahmah, F., Zalillah, S. I., Kusuma, I. D. M. A. W., Syafii, I., Bulqini, A., Fajar, M. K., & Bharlaman, M. B. F. (2025). Using small-sided games or their combination with speed endurance training: Which is more effective for improving aerobic capacity in young amateur league soccer players? Physical Education Theory and Methodology, 25(3), 486-491. https://doi.org/10.17309/tmfv.2025.3.02

Nuttouch, W., Hemarachatanon, P., & Huntula, S. (2023a). Analysis of positional differences in the Thai national football team players' performance using global positioning system tracking. Physical Education Theory and Methodology, 23(3), 373-379. https://doi.org/10.17309/tmfv.2023.3.09

Nuttouch, W., Hemarachatanon, P., & Huntula, S. (2023b). The effect of an 8-week online high-intensity interval training program on body composition and performance in Thai professional football players during the COVID-19 epidemic. Physical Education Theory and Methodology, 23(6), 819-824. https://doi.org/10.17309/tmfv.2023.6.02

Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan: A web and mobile app for systematic reviews. Systematic Reviews, 5, Article 210. https://doi.org/10.1186/s13643-016-0384-4

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hrobjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021a). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372, Article n71. https://doi.org/10.1136/bmj.n71

Page, M. J., Moher, D., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hrobjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... McKenzie, J. E. (2021b). PRISMA 2020 explanation and elaboration: Updated guidance and exemplars for reporting systematic reviews. BMJ, 372, Article n160. https://doi.org/10.1136/bmj.n160

Panasci, M., Castagna, C., Rago, V., Ferrando, V., Ruggeri, P., & Faelli, E. (2025). Effects of a 4-week off-season high-intensity training program on aerobic performance and sprint endurance ability in adolescent female football players: A pilot study. Journal of Functional Morphology and Kinesiology, 10(4), Article 396. https://doi.org/10.3390/jfmk10040396

Prasad, B., Saha, S., Das, S., Singh, R. K., Dalpie, M. A., Obhrai, S., & Mondal, P. (2025). The effects of an eight-week small-sided game-based high-intensity interval training intervention and traditional high-intensity interval training intervention on physical fitness in youth female soccer players. Physical Education Theory and Methodology, 25(5), 1100-1109. https://doi.org/10.17309/tmfv.2025.5.09

Purba, R. H., & Susanti, S. A. (2021). IMT and VO2max analysis on junior athletes, futsal and football branches: Literature Scopus. Journal of Human Sport and Exercise, 16(Proc2), 508-521. https://doi.org/10.14198/jhse.2021.16.Proc2.35

Quan, Y., Zhao, Y., Musa, R. M., Morgans, R., Silva, R. M., Hung, C.-H., & Chen, Y.-S. (2024). Assessing physical fitness adaptations in collegiate male soccer players through training load parameters: A two-arm randomized study on combined small-sided games and running-based high-intensity interval training. Frontiers in Physiology, 15, Article 1466386. https://doi.org/10.3389/fphys.2024.1466386

Rosdi, M. H., Kosni, N. A., Sanuddin, N. D., Azam, Z., Zanudin, M. Z. F., Sinnathamby, V., Faozi, M. A. M., Azmi, M. A. M., & Khalidi, M. K. A. (2025). Association between physical fitness and injury patterns in young footballers of the National Football Development Programme in Malaysia. Sri Lanka Journal of Child Health, 54(3), 204-211. https://doi.org/10.4038/sljch.v54i3.11303

Sanpasitt, C., Yongtawee, A., Noikhammueang, T., Likhitworasak, D., & Woo, M. (2023). Anthropometric and physiological predictors of soccer skills in youth soccer players. Physical Education Theory and Methodology, 23(5), 678-685. https://doi.org/10.17309/tmfv.2023.5.04

Saputra, M., & Putra, A. N. (2025). Optimizing long passing: A study on the relationship between waist flexibility in soccer players. Retos, 64, 629-636. https://doi.org/10.47197/retos.v64.110914

Siby, D., Rajkumar, N. C. J., Salvi, N. M., Karmakar, D., Valappil, I. N. K., Orhan, B. E., Boby, F. A., & Astuti, Y. (2025). Does three sessions of 12-week plyometric training per week improve physical fitness parameters in professional male soccer players? A randomized controlled trial. Fizjoterapia Polska, 2025(1), 84-93. https://doi.org/10.56984/8ZG007DDZ6Q

Siramaneerat, I., & Chaowilai, C. (2022). Impact of specialized physical training programs on physical fitness in athletes. Journal of Human Sport and Exercise, 17(2), 435-445. https://doi.org/10.14198/jhse.2022.172.18

Som, M. A. H. H. M., Vasanthi, R. K., Subramaniam, A., & Nadzalan, A. M. (2022). Knowledge, attitudes and practices of injury prevention towards lateral ankle sprain among amateur football players in Brunei. Pedagogy of Physical Culture and Sports, 26(2), 111-117. https://doi.org/10.15561/26649837.2022.0205

Sousa, H., Clemente, F. M., Sarmento, H., Gouveia, E. R., & Musa, R. M. (2024). Comparing locomotor intensity indicators in soccer training and competition across contextual factors: A study of replaced coaches in a Portuguese professional 1st league team. Frontiers in Sports and Active Living, 6, Article 1391784. https://doi.org/10.3389/fspor.2024.1391784

Sukriadi, S., Setiakarnawijaya, Y., Tangkudung, J., Dlis, F., Dwi, D. R. A. S., Arif, M., Fadillah, B., Fitranto, N., & Setiawan, I. (2023). Analysis of physical fitness profile of athletes with intellectual disability in

Special Olympics Indonesia (SOIna) after the COVID-19 pandemic. International Journal of Human Movement and Sports Sciences, 11(5), 1044-1059. https://doi.org/10.13189/saj.2023.110513

Sun, M., Soh, K. G., Ma, S., Wang, X., Zhang, J., & Yaacob, A. B. (2025). Effects of speed, agility, and quickness (SAQ) training on soccer player performance: A systematic review and meta-analysis. PLOS ONE, 20(2), Article e0316846. https://doi.org/10.1371/journal.pone.0316846

Tajudin, F. I. M., Malek, N. F. A., Azmi, A. M. N., Tan, K., Vasanthi, R. K., Abadi, F. H., & Nadzalan, A. M. (2022). The effects of small-sided games versus traditional training on physical fitness and skills among Under-12 hockey players. Pedagogy of Physical Culture and Sports, 26(4), 270-275. https://doi.org/10.15561/26649837.2022.0407

Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. BMC Medical Research Methodology, 8, Article 45. https://doi.org/10.1186/1471-2288-8-45

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. British Journal of Management, 14(3), 207-222. https://doi.org/10.1111/1467-8551.00375

Welis, W., & Mario, D. T. (2023). Sports massage: How does it affect reducing lactic acid levels in athletes? International Journal of Human Movement and Sports Sciences, 11(1), 20-26. https://doi.org/10.13189/saj.2023.110103

Xu, W., & Xie, S. (2024). Effect of football activities on social skills and the physical fitness of children aged 5-6 years. Pakistan Journal of Life and Social Sciences, 22(1), 6592-6604. https://doi.org/10.57239/PJLSS-2024-22.1.00482

Yapici, H., Soylu, Y., Gulu, M., Kutlu, M., Ayan, S., Muluk, N. B., Aldhahi, M. I., & AL-Mhanna, S. B. (2023). Agility skills, speed, balance and CMJ performance in soccer: A comparison of players with and without a hearing impairment. Healthcare, 11(2), Article 247. https://doi.org/10.3390/healthcare11020247

Yusni, Y., Meutia, F., & Taufik, N. H. (2025). The advantageous correlation between anthropometry and physical fitness in amateur soccer players. Retos, 67, 985-995. https://doi.org/10.47197/retos.v67.112998