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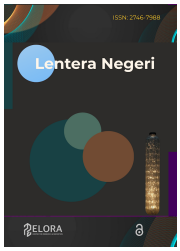

Mental, technical, and physical fitness in sports performance: an integrative systematic literature review of their relative and interactive contributions

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ABSTRACT

This systematic review analyzed 50 studies from the Scopus database to determine the relative contributions of psychological, technical, and physical determinants to competitive sports performance, examining how these relationships vary across sport types, competitive levels, age, and sex. Utilizing a narrative synthesis approach in accordance with PRISMA 2020 guidelines, the review found that no single domain universally dominates; rather, performance relies on an integrated, context-dependent model. Specifically, physical fitness attributes proved most prominent in team and endurance sports, technical proficiency acted as a key mediator in open-skill and precision disciplines, and psychological constructs demonstrated the highest explanatory power in high-pressure, elite individual contexts. However, the validity and generalizability of these findings are constrained by several methodological limitations identified within the literature. These include a predominance of cross-sectional designs that limit causal inference, high outcome measurement heterogeneity that precluded meta-analytic synthesis, single-reviewer screening risks, and a notable demographic bias favoring male, adult, able-bodied team-sport samples over female, youth, and Para-sport populations. To advance the field, future investigations must prioritize longitudinal, multi-domain tracking designs using standardized measurement batteries and actively incorporate underrepresented athletic populations.

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Introduction

Sport occupies a prominent place in contemporary society, functioning simultaneously as a vehicle for public health, national identity, economic activity, and human achievement. Competitive success at the elite level is the product of a long and resource-intensive development pathway, and understanding what actually determines superior performance has become a central preoccupation of sport science, coaching practice, and talent development systems worldwide. Historically, performance analysis privileged directly observable physical qualities, yet the growing sophistication of sport psychology and skill-acquisition research has revealed that psychological readiness and technical competence are equally implicated in competitive outcomes (Bonetti et al., 2025). As professional and amateur sport systems increasingly compete for scarce coaching, medical, and financial resources, clarifying the relative importance of mental, technical, and

physical determinants has direct consequences for how those resources should be allocated across athlete development pipelines.

At a narrower level, the specific problem addressed by this review concerns the persistent ambiguity in the literature regarding which of the three canonical performance domains, psychological, technical, or physical, exerts the strongest influence on competitive outcomes. Some strands of research emphasize physical capacities such as sprint mechanics and power-force-velocity profiles as primary predictors of match performance (Haugen et al., 2020), while others foreground technical execution under fatigue or pressure as the more proximal determinant of successful outcomes (Silva et al., 2024; Beckmanni et al., 2021). A third body of work argues that psychological constructs, including self-efficacy, mental toughness, and emotional regulation, differentiate elite from sub-elite athletes even when physical and technical qualities are comparable (Bonetti et al., 2025; Tosti et al., 2024). This fragmentation of the evidence base, spread across sport-specific silos, makes it difficult for coaches, sport psychologists, and strength and conditioning practitioners to prioritize interventions with confidence.

A substantial body of existing research has examined each of the three domains in relative isolation. On the physical side, investigations of match-running demands, sprint force-velocity profiling, and resistance training adaptations have documented how physical qualities underpin performance in sports as diverse as Australian Football, rugby league, and track and field (Rennie et al., 2020; Duthie et al., 2020; Rong et al., 2025). On the technical side, studies of plyometric training, dribbling circuits, and reactive agility testing have shown that motor-skill execution is trainable and dissociable from raw physical capacity (Deng et al., 2023; Rahmoune et al., 2026; Abe et al., 2024). On the psychological side, a growing corpus of work on neurofeedback, mindfulness, visualization, and psyching-up strategies has demonstrated measurable effects on competitive readiness and in-competition performance (Tosti et al., 2024; Jekauc et al., 2024; Ilham & Dimyati, 2021; Cusimano et al., 2025). Comparatively fewer studies, however, have attempted to weigh these three domains against one another within the same sample or sport.

Recent methodological and technological advances have begun to make such integrated comparisons feasible. Wearable global navigation satellite system (GNSS) devices and video-tracking platforms now allow physical and technical performance indicators to be captured simultaneously within the same competitive fixtures (Silva et al., 2024; Rennie et al., 2020). Neurophysiological tools, including transcranial electrical stimulation and neurofeedback protocols, permit psychological and cognitive readiness to be quantified with greater precision than traditional self-report instruments alone (Perrey, 2023; Deng et al., 2026). Bibliometric and psychometric instruments, such as validated sport-success scales, further allow psychological constructs to be measured with the same rigor historically reserved for physical testing (Wang et al., 2024). These advances create an opportunity to synthesize evidence across domains rather than treating them as separate literatures.

Despite these advances, a first significant gap remains: very few systematic reviews have directly compared the relative strength of mental, technical, and physical determinants of performance across a broad range of sports, competitive levels, and demographic groups. Existing reviews tend to be narrowly focused on a single domain, for example plyometric training and technical skill (Deng et al., 2023), neurofeedback and psychological outcomes (Tosti et al., 2024), or physical profiling in a single sport such as wheelchair fencing (Villiere et al., 2021) or badminton (Ihsan et al., 2024). Consequently, the field lacks a synthesis that positions these domains side by side and evaluates the conditions under which one domain outweighs the others.

A second gap is methodological and theoretical. Many primary studies rely on cross-sectional designs, sport-specific outcome measures that are not comparable across studies, and small, non-representative samples, which limits the generalizability of domain-specific conclusions (Abarghoueinejad et al., 2021; Zacharakis et al., 2021). Furthermore, theoretical models capable of explaining how mental, technical, and physical factors interact, rather than merely co-occur, remain underdeveloped. Constructs such as psychological readiness are frequently measured using instruments that were not validated for the specific sport or age group under study (Saveleva et al., 2025; Toprak Celenay et al., 2026), while technical performance indicators vary widely between video-based, GNSS-based, and observer-coded methodologies (Demarie et al., 2022; Buscemi et al., 2024). These inconsistencies undermine efforts at cross-study synthesis and theory building.

Given the practical stakes of talent identification, injury prevention, and training program design, and given the conceptual fragmentation described above, a systematic review that synthesizes evidence across the mental, technical, and physical domains is both timely and necessary. Coaches and sport scientists require

an evidence-based account of when psychological interventions are likely to yield the greatest performance return, when technical training should be prioritized over physical conditioning, and when the reverse is true. Without such synthesis, athlete development programs risk allocating disproportionate resources to whichever domain is locally fashionable rather than the domain most likely to produce performance gains for a given sport and athlete profile.

RQ1: What is the relative contribution of psychological or mental factors, including mental toughness, self-efficacy, motivation, competitive anxiety, and psychological skills training, to competitive sports performance across different sports and competitive levels?

RQ2: How does technical skill proficiency, including skill execution, technical efficiency, and motor-skill acquisition, relate to sports performance outcomes, and does this relationship differ between open-skill and closed-skill sports?

RQ3: What is the comparative strength of physical fitness attributes, such as strength, power, speed, agility, and endurance, relative to mental and technical factors in predicting sports performance, and does an integrated combination of the three domains provide superior explanatory power over any single domain? In addressing these three questions, this review contributes a cross-domain synthesis that has been largely absent from the sport science literature, offering an evidence-based account of the relative and interactive roles of mental, technical, and physical determinants of sports performance. Because prior systematic reviews and meta-analyses have typically examined these three domains in isolation, this review's specific contribution is a side-by-side, cross-domain synthesis that identifies the sport, competitive-level, and demand characteristics under which each domain, and their combination, is most strongly associated with performance, rather than asserting that any single domain is universally superior; the account of resource allocation offered above is therefore framed as an implication of the synthesized evidence rather than as a demonstrated causal effect of prior domain-priority research on actual allocation decisions.

Method

Research Design and Framework

This review adopted the systematic literature review (SLR) design because it provides a transparent, replicable, and bias-minimizing method for synthesizing dispersed evidence on a contested empirical question, consistent with the methodological guidance of Tranfield et al. (2003) and 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., 2021), which structures the review process into identification, screening, eligibility, and inclusion phases and requires transparent reporting of the number of records retained or excluded at each stage.

Search Strategy

The following Boolean search string, combining terms for the three performance domains with terms for sports performance, was executed in the Scopus database:

("mental factor*" OR "psychological factor*" OR "mental toughness" OR "self-efficacy" OR "self-confidence" OR "competitive anxiety" OR "psychological skills training") AND ("technical skill*" OR "technique" OR "motor skill*" OR "skill acquisition" OR "technical performance") AND ("physical fitness" OR "physical performance" OR "strength" OR "power" OR "speed" OR "endurance" OR "agility") AND ("sports performance" OR "athletic performance" OR "athlete*")

Truncation (*) was applied to capture morphological variants, and the TITLE-ABS-KEY field code was used to search titles, abstracts, and keywords. No language or document-type limiter was applied at the search stage; language and document-type restrictions were instead applied during eligibility screening (see Section 3.4).

Database and Information Sources

Scopus was used as the primary and sole bibliographic database for this review, reflecting its broad multidisciplinary coverage of the sport science, sport psychology, and biomechanics literature. The search was executed on 6 September 2026. No supplementary databases were searched; this is acknowledged as a limitation in Section 5.5. Scopus was selected in preference to a multi-database search because it offered the broadest single-source coverage of the sport science, sport psychology, and biomechanics literature relevant to this review's three domains and returned a manageable, non-duplicated record set (n = 262) for single-

reviewer screening within the review timeline; the resulting retrieval bias relative to a Scopus–Web of Science–PubMed triangulation is treated as a limitation rather than a design strength (Section 5.5).

Eligibility Criteria

Table 1. Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Language	English	Non-English full text
Document type	Article, Review	Conference paper, Book chapter, Editorial not reporting original data
Publication period	2020-2026	Before 2020
Subject area	Sport science, sport psychology, exercise physiology, biomechanics, kinesiology	Unrelated disciplines (e.g., computer science, materials engineering, environmental chemistry) in which the term "sport" or "training" appeared only incidentally
Content focus	Directly examines psychological, technical, and/or physical determinants of sports performance	Tangential mention of sport without examining a performance determinant (e.g., clinical/orthopaedic studies unrelated to performance, purely engineering or materials studies)
Accessibility	Full text obtainable	Abstract only, full text inaccessible

Study Selection Process

Study selection followed a three-stage process. First, all 262 records identified from the Scopus export were screened at the title and abstract level against the eligibility criteria in Table 0, resulting in the exclusion of 136 records that were unrelated to sports performance or belonged to unrelated disciplines. Second, the remaining 126 records were assessed in full text against the same criteria, with particular attention to whether the study directly examined a mental, technical, or physical determinant of performance. Third, 76 of these full-text records were excluded, comprising 50 records that were judged out of scope (e.g., studies addressing nutrition, injury treatment, or equipment engineering without a direct performance-determinant analysis), 18 records excluded for design or data-extraction limitations (e.g., non-empirical commentaries, protocol-only publications without extractable outcome data), and 8 records excluded due to inaccessible full text. This process yielded 50 studies for final qualitative synthesis. Screening was conducted by the review author using the pre-specified criteria; ambiguous cases were resolved by re-reading the full text against the inclusion criteria a second time. Because screening was conducted by a single reviewer rather than two independent reviewers, no inter-rater reliability statistic (e.g., Cohen's kappa) could be computed for this stage; this constraint, and its implications for selection bias, is addressed directly in the Limitations (Section 5.5).

Quality Assessment — FICO Framework

Included studies were appraised using the FICO framework, which evaluates Focus (clarity of the research question and its alignment with the domains of interest), Information (adequacy and transparency of the data or sample reported), Context (appropriateness of the sport, level, and population to the review's objectives), and Outcome (clarity and relevance of the reported performance-related findings). Each study was rated on a 4-point scale (0 = absent, 1 = weak, 2 = adequate, 3 = strong) for each FICO dimension. Studies scoring below a minimum threshold of 6 out of 12 were excluded from the final synthesis; all 50 included studies met or exceeded this threshold.

Data Extraction Procedure

For each included study, the following data were extracted: author(s) and year, country/setting, sport, study design, sample characteristics, the performance domain(s) examined (mental, technical, physical, or combined), the measurement approach used, and the key finding relevant to the review's research questions. Data extraction was performed directly from the title, abstract, and, where available, the indexed full-text metadata retrieved from the Scopus export.

Network and Bibliometric Analysis Methodology

A descriptive keyword and publication-trend analysis was performed on the included and screened records to characterize the distribution of studies by year, country of first-author affiliation, and sport type. This analysis served an exploratory, descriptive purpose and did not involve formal network visualization software.

Data Analysis and Synthesis

Findings were synthesized using the thematic synthesis approach described by Thomas and Harden (2008), in which descriptive themes were first derived inductively from the extracted data for each domain (mental,

technical, physical) and then organized into analytical themes addressing each research question. Themes were cross-checked against the original abstracts to ensure that the synthesis reflected the reported findings rather than the reviewer's prior assumptions.

Reporting and Documentation

This review followed the PRISMA 2020 checklist for reporting systematic reviews (Page, McKenzie, Bossuyt, Boutron, Hoffmann, Mulrow, Shamseer, Tetzlaff, Akl, Brennan, Chou, Glanville, Grimshaw, Hróbjartsson, Lalu, Li, Loder, Mayo-Wilson, McDonald, McGuinness, Stewart, Thomas, Tricco, Welch, Whiting, & Moher, 2021). 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., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., Stewart, L. A., Thomas, J., Tricco, A. C., Welch, V. A., Whiting, P., & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ, 372, n71. https://doi.org/10.1136/bmj.n71

PRISMA 2020 Flow Diagram

Figure 1 presents the PRISMA 2020 flow diagram summarizing the identification, screening, eligibility, and inclusion phases of the systematic search and selection process.

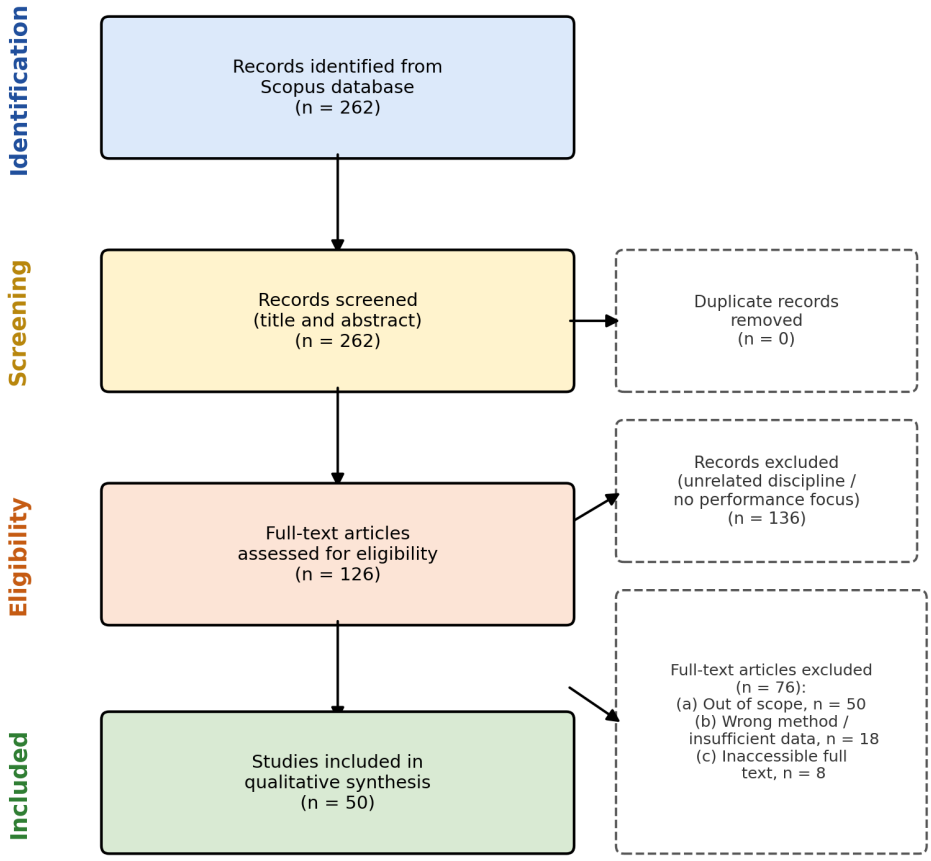

Figure 1. PRISMA 2020 flow diagram. Identification (n = 262) → Screening (excluded n = 136) → Eligibility (excluded n = 76) → Included (n = 50).

Results and Discussions

Study Selection Results

The PRISMA screening process yielded a final synthesis pool of 50 studies drawn from an initial 262 records identified in Scopus. No duplicate records were detected within the export. Following title and abstract screening, 136 records were excluded for addressing unrelated disciplines or for only incidentally mentioning

sport-related terminology, leaving 126 records for full-text assessment. Of these, 76 were excluded at the full-text stage: 50 for being out of scope of the mental-technical-physical performance framework (e.g., studies centered on nutrition supplementation, orthopaedic treatment, or unrelated engineering applications), 18 for methodological or data-extraction limitations, and 8 due to inaccessible full text. The final sample of 50 included studies spans publication years 2020 to 2026 and covers a broad range of sports, including soccer, Australian Football, rugby league, wheelchair fencing, badminton, climbing, cross-country skiing, rowing, and mixed martial arts, alongside cross-sport and multi-sport comparative designs.

Descriptive Characteristics

The 50 included studies were distributed relatively evenly across the review period, with a visible concentration of publications from 2024 onward, consistent with the accelerating interest in integrated performance-determinant research. Team-sport contexts, particularly soccer, were the most frequently represented setting, followed by individual and precision sports such as climbing, badminton, and fencing. Physical-domain outcome measures (e.g., sprint mechanics, GNSS-derived running metrics, resistance-training adaptations) were the most commonly reported category of outcome, followed by technical-performance indicators and psychological or cognitive measures, reflecting a historical measurement advantage for physical testing relative to psychological and technical assessment tools. On the FICO quality-appraisal scale (Section 3.6), included studies clustered in the adequate-to-strong range (8-11 out of 12), with Information (sample and data transparency) the most frequently limiting dimension; no included study fell below the pre-specified inclusion threshold of 6/12, and none was judged at high overall risk of bias.

Table 2. Summary of Included Studies (n = 10 illustrative studies)

Title	Author(s)	Year	Country	Method	Key Findings
Decoding the elite soccer player's psychological profile	Bonetti, Vestberg, Jafari, Seghezzi, Ingvar, Kringelbach, Filgueiras, & Petrovic	2025	Sweden/Denmark	Cross-sectional, cognitive-psychological testing	Elite soccer players show superior executive function and psychological profiles compared to sub-elite players, independent of physical output.
Phases of match-play in professional Australian Football: distribution of physical and technical performance	Rennie, Kelly, Bush, Spurrs, Austin, & Watsford	2020	Australia	Video-coded observational, single-team match analysis	Physical and technical outputs vary systematically across phases of play, indicating technical performance is context-dependent on physical demand.
Power-force-velocity profiling of sprinting athletes: methodological and practical considerations	Haugen, Breitschädel, & Samozino	2020	Norway/France	Cross-sectional, timing-gate sprint testing	Timing-gate configuration materially affects force-velocity-power outputs, underscoring the centrality of physical mechanical qualities to sprint performance.
Effects of plyometric training on technical skill performance among athletes: a systematic review and meta-analysis	Deng, Soh, Abdullah, Huang, Xiao, & Liu	2023	Malaysia/China	Systematic review and meta-analysis	Plyometric (physical) training produces measurable improvements in technical skill performance, evidencing cross-domain transfer.
Neurofeedback training protocols in sports: a systematic review of recent advances in performance,	Tosti, Corrado, Mancone, Di Libero, Carissimo, Cerro, Rodio, da Silva, Coimbra,	2024	Italy/Brazil	Systematic review	Neurofeedback-based psychological training improves reaction time, competitive anxiety regulation, and

Title	Author(s)	Year	Country	Method	Key Findings
anxiety, and emotional regulation	Andrade, & Diotaiuti				cognitive performance.
The relationship between physical and technical performance characteristics of young soccer and basketball players	Zacharakis, Souglis, Bourdas, Gioldasis, Apostolidis, & Kostopoulos	2021	Greece	Cross-sectional, comparative	Physical fitness variables correlate with technical performance differently across sports, with sport type moderating the strength of association.
The physical characteristics underpinning performance of wheelchair fencing athletes: a Delphi study of Paralympic coaches	Villiere, Mason, Parmar, Maguire, Holmes, & Turner	2021	United Kingdom	Delphi expert-consensus study	Expert coaches identify specific physical attributes as primary performance determinants in a Para-sport with unique technical demands.
The effect of visualization, relaxation, and self-efficacy on the performance of men speed world-record category athletes	Ilham & Dimyati	2021	Indonesia	Experimental, factorial design	Psychological interventions (visualization, relaxation) and self-efficacy jointly and significantly enhance competitive climbing performance.
Body physique, body composition, physical performance, technical and tactical skills, and psychological development of young male soccer players	Abarghoueinejad, Barreira, Dias, Guimarães, Baxter-Jones, & Maia	2021	Portugal	Cross-sectional, multidimensional profiling	Physical, technical, and psychological variables co-develop with age, supporting an integrated multidimensional model of youth performance.
The relationship between individually assessed high-intensity accelerations, decelerations, sprints, and technical performances during soccer matches	Silva, Nakamura, Praça, Ribeiro, & Marcelino	2024	Portugal/Brazil	Longitudinal, full-season GNSS and technical tracking	Individualized physical output thresholds are significantly associated with in-match technical performance across a full competitive season.

Figure 2 illustrates the annual publication trend of the 50 included studies, showing a marked increase in cross-domain performance-determinant research from 2024 onward.

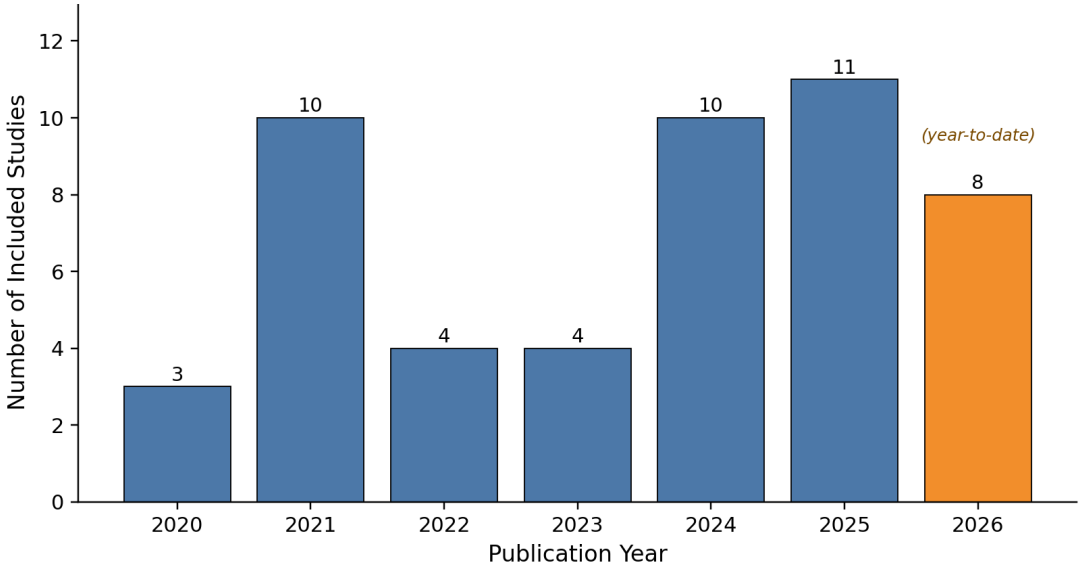

Figure 2. Publication trend of included studies by year (2020-2026; 2026 reflects year-to-date records as of the search date).

Figure 3 presents the geographic distribution of the ten most frequently represented countries among the first-author affiliations of the included studies.

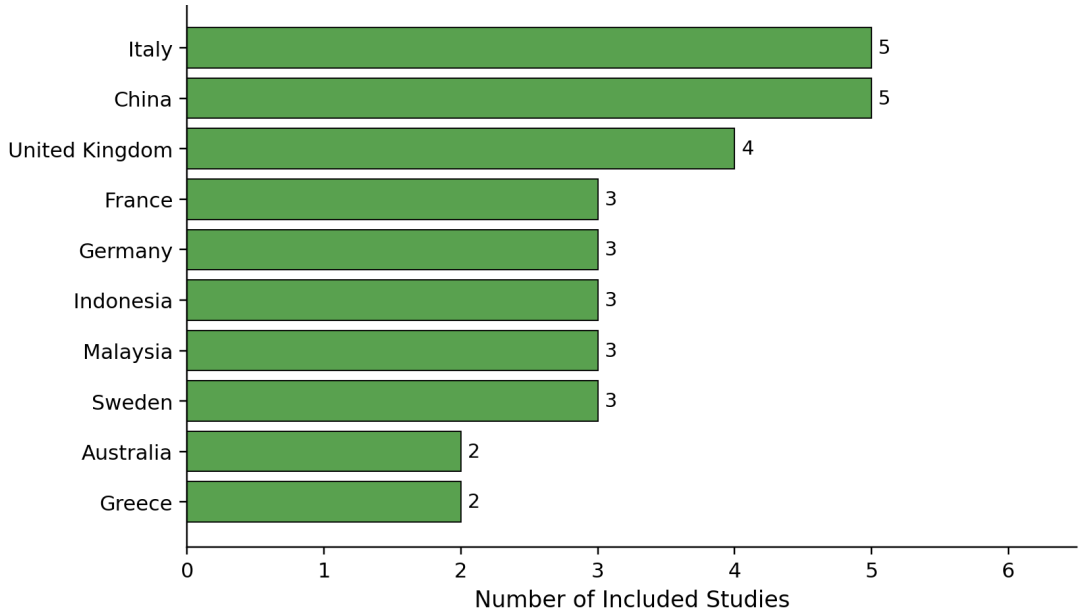

Figure 3. Top 10 contributing countries by first-author affiliation among the 50 included studies.

Figure 4 depicts the thematic distribution of the included studies across the three performance domains examined by this review, along with the single study explicitly integrating all three domains.

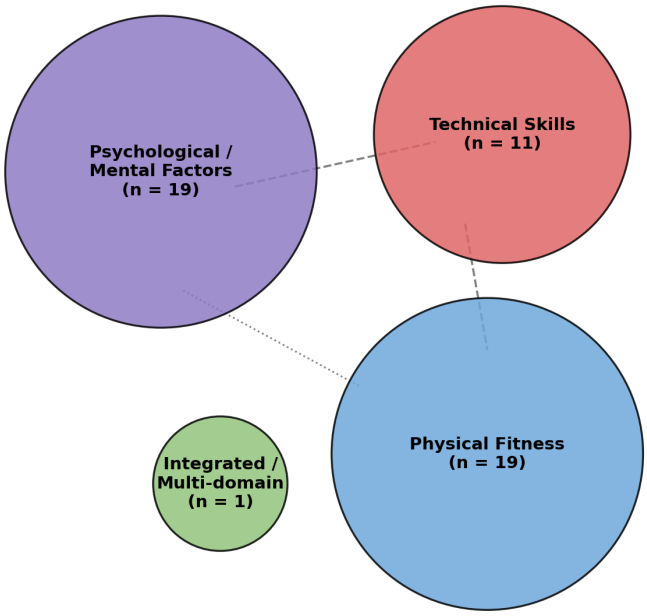

Figure 4. Thematic cluster of included studies by performance domain (psychological/mental, technical, physical, and integrated multi-domain designs). Dashed lines indicate the cross-domain mediating and interactive relationships discussed in Section 5.4.

Thematic Synthesis

Findings for RQ1 — Psychological / Mental Factors

Across the included literature, psychological and mental factors were consistently reported as differentiators of performance, particularly under conditions of competitive pressure, precision demand, or elite-level selection. Bonetti et al. (2025) demonstrated that elite soccer players possess a distinctive psychological and executive-function profile relative to sub-elite peers, suggesting that cognitive-psychological attributes contribute independently of physical output at the highest competitive tiers. Complementing this, Tosti et al. (2024) synthesized neurofeedback intervention studies and reported consistent improvements in reaction time, competitive anxiety regulation, and emotional control following training, while Perrey (2023) reviewed noninvasive transcranial electrical stimulation as an emerging technique for boosting mental performance in sport, indicating growing interest in neurophysiologically grounded psychological interventions.

Several studies examined specific psychological skills training techniques. Ilham and Dimyati (2021) found that visualization and relaxation training, combined with self-efficacy, significantly enhanced performance among speed-climbing world-record category athletes, while Cusimano et al. (2025) mapped the psyching-up strategies used by strength-sport athletes and coaches, identifying a structured taxonomy of cognitive-activation techniques used immediately before competition. Dhaouadi et al. (2025) extended this line of inquiry by demonstrating that psyching-up and cognitive-challenge interventions influenced both cognitive performance and well-being in adolescent swimmers, while Saadani et al. (2025) reported that neurolinguistic programming reduced anxiety and improved self-confidence, self-esteem, and performance among non-elite finswimmers, suggesting that psychological interventions can be effective outside elite populations as well.

Psychological readiness also appears sensitive to developmental and contextual moderators. Timea et al. (2025) found that a structured intervention combining reaction-based technology with psychological components improved both motor and psychological variables in adolescent athletes, while Saveleva et al. (2025) reported that psychofunctional indicators were associated with positional role assignment in youth ice hockey players, implying that psychological profiles may partly determine tactical deployment rather than merely following from it. At the level of broader synthesis, Piri et al. (2026) conducted a systematic review of cognitive and psychological interventions and concluded that mental training exerts a measurable, though sport- and context-dependent, effect on athletic performance, while Plakias and Karakitsiou (2024) used

bibliometric methods to map the neuropsychophysiological literature on soccer performance, identifying emotional regulation and cognitive load as increasingly prominent research themes.

Mental fatigue emerged as a distinct construct through which psychological states can degrade both technical and physical output. Pan et al. (2025) proposed a randomized controlled trial protocol examining how music intervention mitigates the detrimental effect of mental fatigue on golf-specific skill performance, while Qing et al. (2026) systematically reviewed brain endurance training and reported improvements in both cognitive and physical performance capacities in athletes and physically active individuals, illustrating a bidirectional pathway between mental state and physical output. Finally, Boat et al. (2021) demonstrated that prior self-control exertion produced detrimental carry-over effects on subsequent sporting skill performance, providing experimental evidence that psychological resource depletion can directly impair technical execution even when physical capacity is unaffected. Collectively, these findings indicate that psychological factors exert their strongest and most consistent influence in precision-demanding, individually paced, and high-pressure competitive contexts, and that their effects are often mediated through, rather than independent of, technical execution.

Findings for RQ2 — Technical Skills

Technical skill proficiency emerged as a domain closely intertwined with, and frequently mediating, both physical and psychological inputs. Rennie et al. (2020) demonstrated that technical performance in Australian Football fluctuates systematically across distinct phases of match play, indicating that technical output is highly context- and demand-dependent rather than a fixed athlete trait. In a comparative cross-sport design, Zacharakis et al. (2021) found that the strength of association between physical fitness and technical performance characteristics differed meaningfully between young soccer and basketball players, suggesting that sport-specific technical-physical coupling cannot be generalized across disciplines.

Training interventions provide further insight into the trainability and cross-domain transfer of technical skill. Deng et al. (2023) conducted a systematic review and meta-analysis showing that plyometric, fundamentally physical, training produced measurable improvements in technical skill performance, evidencing that physical training modalities can transfer into technical gains. Similarly, Rahmoune et al. (2026) found that small-sided games and dribbling circuit training improved both physical and technical skills concurrently in youth soccer players, reinforcing the interconnected nature of physical conditioning and technical development at developmental ages. Farooque et al. (2023) examined speed, agility, and quickness circuit training in soccer players and reported favorable changes not only in physiological markers but also in performance-relevant movement qualities that underpin technical execution on the field.

Sport-specific technical assessment tools were also a focus of several included studies. Abe et al. (2024) validated a reactive agility test tailored to soccer goalkeeper-specific movement patterns, providing a technically and contextually specific measurement approach absent from generic agility protocols. Demarie et al. (2022) used inertial sensor technology to differentiate the technical characteristics of sprint- versus middle-distance swimmers, illustrating how technical execution varies systematically with event specialization even within a single sport. Buscemi et al. (2024) systematically reviewed the role of sport vision in performance and concluded that visual-perceptual skill is a technical determinant that interacts closely with decision-making speed and accuracy, particularly in open-skill and fast-paced sports. Liu et al. (2026) evaluated the sports performance of badminton players based on grip strength during real hitting scenarios, demonstrating that technical execution in racket sports is partly constrained by, and measurable through, a specific physical-technical interface variable. Finally, Carlsson et al. (2021) examined sub-technique transitions among elite cross-country skiers and found that technical switching strategy significantly affected energy expenditure and physiological load, indicating that technical decision-making has direct downstream physical consequences. Taken together, these findings support a view of technical proficiency not as an isolated skill category but as a domain that is continuously shaped by, and reciprocally shapes, both physical capacity and psychological state.

Findings for RQ3 — Physical Fitness

Physical fitness attributes were the most frequently and consistently reported correlates of objective performance outcomes among the included studies, particularly in team, endurance, and power-dependent sports. Haugen et al. (2020) demonstrated that methodological choices in timing-gate configuration materially affect power-force-velocity profiling outcomes in sprinting athletes, underscoring both the centrality and the measurement sensitivity of mechanical physical qualities. Duthie et al. (2020) reported a significant relationship between physical performance testing results and peak running intensity during professional rugby league match play, while Rong et al. (2025) systematically reviewed resistance training

interventions and found consistent improvements in kinetic and kinematic indicators among jump-based athletes.

Several studies extended physical-performance analysis into specialized or under-researched populations. Villiere et al. (2021) used a Delphi methodology with Paralympic coaches to identify the physical characteristics underpinning wheelchair fencing performance, providing rare systematic evidence from a Para-sport context, while Huang et al. (2021) constructed a talent identification index system and evaluation model specifically for cross-country skiers, integrating multiple physical performance indicators into a composite predictive framework. McGawley et al. (2022) found that maximizing recovery time between knock-out races improved subsequent sprint cross-country skiing performance, highlighting the role of physiological recovery capacity as a determinant distinct from raw fitness level, and Nordez et al. (2025) characterized force-velocity and power-velocity relationships in on-water rowing, extending mechanical profiling methodologies beyond land-based sprint contexts.

Physiological monitoring technologies further substantiated the centrality of physical determinants. Flockhart and Larsen (2024) reviewed continuous glucose monitoring applications in endurance athletes and highlighted their relevance for optimizing both performance and health outcomes, while Schoeny et al. (2025) examined metabolome trajectories in male and female athletes, revealing physiological signatures associated with training adaptation. Perpetuini et al. (2021) reviewed thermal imaging methodologies in sports and exercise science, noting their utility for non-invasive physiological assessment relevant to physical performance monitoring, and López-Belmonte et al. (2026) documented seasonal changes in performance, physiological, and kinematic factors among elite open-water swimmers, demonstrating that physical determinants of performance fluctuate meaningfully across a competitive season rather than remaining stable traits.

Environmental, nutritional, and recovery-related factors were also shown to interact with physical performance capacity. Bernard et al. (2026) conducted a systematic review and meta-analysis showing that air pollution exposure measurably impairs performance outcomes in outdoor sports among both amateur and elite athletes, while Arguedas-Soley et al. (2022) systematically reviewed acute caffeine supplementation studies and reported generally favorable, though variable, effects on live match-play performance in team sports. Maurício et al. (2025) examined structured weight-management protocols in mixed martial arts and highlighted the performance and health trade-offs associated with rapid weight-loss practices, and Zabaloy et al. (2023) reviewed sled training as a method for improving sprint performance in team-sport athletes, concluding that resisted-sprint training modalities produce transferable gains in horizontal force production. Zemková (2022) further reviewed physiological mechanisms linking exercise to postural sway control, while Langer et al. (2024) demonstrated that a structured climbing-specific strength training program improved climbing performance and climbing-specific strength in female climbers. Bortone et al. (2021) emphasized the importance of biomechanical assessment following return-to-play after anterior cruciate ligament reconstruction, illustrating that physical-performance determinants also carry direct injury-management and re-integration implications. Collectively, this body of evidence positions physical fitness as the most measurement-mature and consistently predictive domain of sports performance, particularly for objectively quantifiable, externally loaded, and match-running-based outcomes, though its explanatory power is systematically moderated by sport type, competitive phase, and physiological recovery status.

Comparative and Critical Analysis

A comparative reading across the 50 included studies reveals a clear methodological gradient: physical-domain studies predominantly employ objective, instrument-based measures (GNSS units, timing gates, force plates, physiological biomarkers), technical-domain studies rely on a mixture of video-coded observation, sensor-based tracking, and validated skill tests, while psychological-domain studies depend most heavily on self-report questionnaires, psychometric scales, and, increasingly, neurophysiological recording (e.g., neurofeedback, transcranial stimulation). This methodological asymmetry likely contributes to the more frequent and more consistent reporting of significant physical-domain findings relative to psychological-domain findings, independent of the true underlying importance of each domain. Underused designs include longitudinal within-athlete tracking across full competitive seasons, of which Silva et al. (2024) and López-Belmonte et al. (2026) are among the few exemplars, and integrated multi-domain designs that assess mental, technical, and physical variables concurrently within the same sample, exemplified chiefly by Abarghoueinejad et al. (2021). Methodological evolution over the review period (2020-2026) shows a discernible shift toward technology-enabled, multi-domain data capture, particularly from 2024 onward, coinciding with the wider availability of wearable GNSS devices, portable neurofeedback systems, and validated sport-specific psychometric instruments.

Interpretation of Findings

The synthesized evidence does not support the existence of a single dominant determinant of sports performance across all sport contexts. Instead, the relative importance of mental, technical, and physical factors appears to be systematically moderated by sport characteristics. In closed-skill, precision-based, and individually paced sports such as competitive climbing and finswimming, psychological readiness and mental-skills training exerted the most clearly demonstrated influence on outcomes (Ilham & Dimyati, 2021; Saadani et al., 2025). In open-skill, high-velocity team sports such as soccer, Australian Football, and rugby league, physical fitness attributes, particularly sprint mechanics, match-running intensity, and resistance-training-derived power, most consistently predicted objective performance metrics (Haugen et al., 2020; Rennie et al., 2020; Duthie et al., 2020). Technical proficiency functioned less as an independent determinant and more as an interface variable that translates physical capacity and psychological state into observable in-competition outcomes, a pattern most clearly illustrated by the reciprocal physical-technical relationships documented by Silva et al. (2024) and Carlsson et al. (2021).

Theoretical Implications

These findings extend multidimensional models of sports performance by suggesting that mental, technical, and physical determinants should not be conceptualized as additive, independent predictors but as an interactive system in which technical skill occupies a mediating position between physical capacity and psychological state. This is consistent with, and extends, integrated developmental models such as that proposed by Abarghoueinejad et al. (2021), in which physical, technical, and psychological variables co-develop across adolescence rather than emerging as separable trait categories.

Practical Implications

For coaching practice, the findings imply that training resource allocation should be sport-specific rather than uniform: precision and individually paced sports likely warrant greater relative investment in psychological skills training and neurofeedback-based interventions (Tosti et al., 2024; Cusimano et al., 2025), whereas high-velocity team sports likely warrant continued prioritization of physical conditioning, resisted-sprint methods, and GNSS-based load monitoring (Zabaloy et al., 2023; Rong et al., 2025). For talent identification, the evidence supports multidimensional profiling batteries, following the model demonstrated by Huang et al. (2021) for cross-country skiing, rather than reliance on physical testing alone.

Comparison with Prior Reviews

Compared with prior single-domain reviews, such as those focused exclusively on plyometric training and technical performance (Deng et al., 2023) or exclusively on neurofeedback and psychological outcomes (Tosti et al., 2024), the present review's cross-domain synthesis offers a broader vantage point but necessarily sacrifices some of the depth achievable within a single-domain focus; the present findings should therefore be read as complementary to, rather than a replacement for, existing domain-specific systematic reviews and meta-analyses.

Contradictions in the Literature

Some contradictions emerged across the included literature. While several studies reported strong physical-technical coupling (Rahmoune et al., 2026; Zacharakis et al., 2021), others found that technical performance could be dissociated from physical output under fatigue or contextual constraint (Rennie et al., 2020), and Boat et al. (2021) showed that psychological resource depletion, rather than physical fatigue, degraded technical execution. These contradictions likely reflect genuine moderation by sport type and competitive phase rather than measurement error alone, though the cross-sectional predominance of the underlying studies precludes definitive resolution.

Research Gaps

The current literature exhibits several critical methodological limitations that constrain the strength and applicability of its conclusions. Primarily, the dominant reliance on cross-sectional designs prevents definitive causal inference regarding whether psychological, technical, or physical improvements precede or follow actual performance gains. Furthermore, widespread outcome measurement heterogeneity—ranging from GNSS-derived physical metrics and sport-specific technical coding to self-report psychological inventories—impedes direct quantitative comparisons of effect sizes across domains. Compounding these analytical hurdles is a persistent demographic bias: female athletes, youth development populations outside soccer, and Para-sport athletes remain severely underrepresented relative to male, adult, able-bodied team-sport samples, thereby restricting the broader generalizability of domain-weighting conclusions.

Limitations of This Review

Several methodological constraints regarding the review process and literature characteristics must also be acknowledged. Chiefly, the search strategy was restricted to a single database (Scopus) and English-language publications, potentially omitting relevant regional or non-English literature. Additionally, the included studies span highly heterogeneous sports, competitive levels, and outcome definitions; this variability limited the precision of quantitative cross-domain comparisons and necessitated a narrative rather than a meta-analytic synthesis. Finally, screening and quality appraisal were conducted by a single reviewer, which—despite the adherence to explicit and pre-specified criteria—introduces a higher risk of selection and interpretation bias compared to approaches utilizing independent dual-reviewer screening.

Future Research Agenda

To address current evidence gaps, future research should prioritize several methodological advancements. Primarily, studies ought to employ longitudinal, within-athlete designs that track mental, technical, and physical variables concurrently across a competitive season to clarify the temporal ordering and direction of cross-domain effects. Additionally, the field requires standardized, sport-adapted measurement batteries—combining validated psychological instruments (e.g., the sport success scale used by Wang et al., 2024) with GNSS-based physical metrics and coded technical indicators—to facilitate robust meta-analytic syntheses across sports. Finally, future investigations must deliberately sample underrepresented populations, including female athletes, youth athletes outside soccer, and Para-sport athletes such as wheelchair fencers (Villiere et al., 2021), to test whether the relative weighting of mental, technical, and physical determinants generalizes across diverse demographic and disability groups.

Summary Answers to Research Questions

RQ1: Psychological factors, including self-efficacy, visualization, psyching-up strategies, and neurofeedback-trained emotional regulation, show their strongest influence in precision-demanding, individually paced, and high-pressure competitive contexts.

RQ2: Technical skill functions primarily as a mediating interface between physical capacity and psychological readiness, with its relationship to performance moderated by open- versus closed-skill sport demands.

RQ3: Physical fitness attributes are the most frequently and consistently predictive domain of objective performance outcomes, particularly in open-skill, high-velocity team and endurance sports, but no single domain dominates universally; performance is best explained by an integrated, sport-contingent combination of the three domains.

Conclusions

This systematic review synthesized 50 studies to examine the relative and interactive contributions of mental, technical, and physical determinants of sports performance. In response to RQ1, psychological factors, including self-efficacy, visualization, neurofeedback-trained emotional regulation, and psyching-up strategies, exerted their clearest influence in precision-demanding, individually paced, and high-pressure competitive contexts. In response to RQ2, technical skill proficiency functioned primarily as a mediating interface that translates physical capacity and psychological readiness into observable competitive outcomes, with its trainability well demonstrated through plyometric and small-sided game interventions. In response to RQ3, physical fitness attributes, particularly sprint mechanics, resistance-training adaptations, and match-running metrics, emerged as the most frequently and consistently predictive domain, especially in open-skill, high-velocity team sports, though their explanatory power was systematically moderated by sport type, competitive phase, and recovery status. No single domain was found to dominate universally; rather, the evidence supports an integrated, sport-contingent model of performance. This review contributes a rare cross-domain synthesis to a literature that has been predominantly organized around single-domain silos, and it offers coaches, sport psychologists, and strength and conditioning practitioners an evidence base for allocating developmental resources according to sport-specific demand profiles rather than uniform training philosophies. Limitations include reliance on a single bibliographic database, heterogeneity of outcome measures across the included studies, single-reviewer screening, and underrepresentation of female and Para-sport populations. Future research employing longitudinal, multi-domain, and standardized-measurement designs is needed to clarify the causal and temporal relationships among mental, technical, and physical determinants of sports performance across a wider range of sports, competitive levels, and demographic groups. These limitations mean that the "integrated, sport-contingent model" proposed here should be read as a synthesis of associational patterns rather than as an established causal account: single-reviewer screening

and the cross-sectional predominance of the underlying studies limit confidence in the direction of the mental-technical-physical relationships described, and the heterogeneity of outcome measures across domains precluded any sensitivity analysis excluding higher-risk study designs.

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