

Review article

Effects of Various Exercise Interventions on Sprint Performance and Jump Height in Soccer Players: A Systematic Review and Network Meta-Analysis

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Abstract

To evaluate and compare the effects of six exercise interventions on sprint performance and vertical jump height in soccer players using a systematic review and network meta-analysis (NMA). A comprehensive literature search was conducted across PubMed, Embase, the Cochrane Library, Web of Science, and SPORTDiscus for randomized controlled trials (RCTs) published from January 2000 to 30 September 2025. Thirty-one eligible studies were included, covering Traditional Strength Training, Plyometric Jump Training, Speed Training, Endurance Training, Flexibility Training, and Regular Training. A frequentist random-effects network meta-analysis was conducted. Outcomes were pre-specified hierarchically, with sprint performance and vertical jump height as co-primary outcomes and COD and IRM as secondary outcomes; secondary outcomes were interpreted as supportive rather than primary evidence. Traditional Strength Training was most effective for 5-m sprint performance (SUCRA = 99.8%; MD = -0.09 s, 95% CI: -0.11 to -0.07), 20-m sprint performance (SUCRA = 89.9%; MD = -0.13 s, 95% CI: -0.20 to -0.06), and squat jump height (SUCRA = 86.2%; MD = 4.40 cm, 95% CI: 2.07 to 6.74). For the 30-m sprint, Speed Training ranked highest by SUCRA (74.2%), but the comparison with Regular Training was not statistically significant (MD = -0.16 s, 95% CI: -0.34 to 0.01). For the 40-m sprint, no intervention showed a statistically significant advantage over Regular Training. Among the pre-specified co-primary outcomes, Traditional Strength Training appears to provide the most consistent benefits for short-sprint acceleration (5 - 20 m) and vertical jump performance in soccer players. Evidence for 30 - 40 m sprint performance was uncertain, and secondary outcomes (COD and IRM) should be interpreted as supportive rather than as the primary basis for overall effectiveness claims. These findings support prioritizing strength-oriented training when short-sprint acceleration and vertical jump performance are key goals; however, the implications should be interpreted cautiously because certainty varied across comparisons and residual uncertainty remains. The protocol for this systematic review was prospectively registered in PROSPERO (CRD42024608868).

Key words: Training modality, soccer-specific conditioning, strength training, plyometric training, speed training, network meta-analysis.

Introduction

Soccer is a high-intensity intermittent sport in which explosive actions such as sprinting, vertical jumping, and rapid changes of direction (COD) are critical to performance (Bloomfield et al., 2007; Gualtieri et al., 2023; Lo-turco et al., 2020). Match analyses suggest that short-distance sprinting is frequently involved in decisive situations, including goal-scoring actions, although these

associations are influenced by tactical context and player role (Bradley et al., 2009; Chmura et al., 2018; Filter et al., 2023). Accordingly, training methods aimed at improving acceleration and maximal-velocity capacity are widely used to enhance match-relevant physical performance (Haugen et al., 2019b; Rumpf et al., 2016). However, conditioning practice in soccer is constrained by congested schedules, technical-tactical demands, and injury risk (Morgans et al., 2014).

For strength and conditioning practitioners, the practical challenge is rarely to choose a single training modality in isolation, because these components are typically embedded within concurrent training weeks alongside technical-tactical sessions and match-related demands. Rather, under time constraints, the key applied question is which training component should receive greater emphasis to maximize performance gains within the overall training week (Enright et al., 2015). While various interventions are commonly used within these concurrent training structures, their relative value when prioritizing one component over another remains a subject of ongoing debate. Therefore, a systematic evaluation using a network meta-analysis (NMA) is essential. Unlike a conventional pairwise meta-analysis, which is limited to direct head-to-head comparisons, an NMA can simultaneously integrate direct and indirect evidence across multiple training modalities and estimate their relative ranking. This approach is particularly valuable in soccer conditioning, where not all intervention types have been compared directly, yet practitioners must still decide which training component should be prioritized to optimize athletic development while balancing performance gains and physical load (Hutton et al., 2015).

Various training modalities, including strength, plyometric, and speed-oriented training, have been used to enhance sprint and jump performance in soccer players. However, an important evidence gap remains. Previous systematic reviews and conventional pairwise meta-analyses have mainly evaluated selected training modalities in isolation or through limited head-to-head comparisons, making it difficult to determine their relative effectiveness across the broader range of conditioning options available in practice (Marshall et al., 2021; Oliver et al., 2024). The present network meta-analysis extends prior pairwise syntheses by integrating both direct and indirect evidence across multiple intervention nodes within a single analytical framework, allowing simultaneous comparison and ranking of six pre-specified exercise modalities. To improve comparability, the included interventions were classified according to their dominant training stimulus into six categories: Traditional Strength Training, Plyometric Jump

or anaerobic metabolic conditioning rather than neuromuscular overload. Flexibility Training included interventions in which static, dynamic, ballistic, or proprioceptive neuromuscular facilitation stretching formed the main additional training content. Regular Training referred to comparison conditions in which participants continued their usual soccer practice without any additional structured physical intervention specifically designed to overload strength, plyometric, speed, endurance, or flexibility qualities; on this basis, it was treated as a relatively low-stimulus active comparator rather than a high-load training condition.

To minimize misclassification bias, a study arm was assigned to a single node only when one modality clearly represented the dominant training stimulus, defined a priori as accounting for at least 60% of the prescribed additional training content, based on session time, number of drills, or number of sets when such information was available. When a program combined two or more modalities without a clearly dominant component, it was classified as multi-component and was not merged into a single-modality node. For incompletely reported protocols, classification was based on the totality of prescription details, including load intensity, repetition range, exercise selection, contraction intent, recovery structure, and the authors' stated training objective. These refinements were implemented to improve within-node homogeneity and strengthen the plausibility of the transitivity assumption, while acknowledging that some residual heterogeneity is unavoidable in applied training studies.

Inclusion and exclusion criteria

Studies were included if they met the following PICOS-based criteria: (1) the experimental group comprised soccer players receiving a specific exercise intervention, with sex and competitive level not used as exclusion criteria; (2) the control group received a different training modality or regular training only; (3) the study design was a randomized controlled trial; (4) at least one co-primary outcome was reported, namely sprint performance at any pre-specified distance or vertical jump height (SJ or CMJ); secondary outcomes of interest were COD performance and maximal strength (1RM), which were extracted when available and synthesized to provide supportive evidence regarding training-specific adaptations; and (5) the full text was available for data extraction. No language restrictions were applied during the initial selection process.

Studies were excluded if they were non-randomized or quasi-randomized controlled trials, secondary research or other non-original articles, or trials with incomplete, missing, or irrecoverable critical data required for the network meta-analysis.

Literature screening and data extraction

No language restrictions were applied. For non-English articles identified during screening, full texts were processed using a standardized translation workflow, with initial machine translation followed by manual verification by two bilingual researchers (Y.W. and Z.L.). For articles written in languages not mastered by the team, professional

translation services or native-speaking academic colleagues were consulted when necessary to confirm eligibility and extract critical data. This procedure was used to implement the no-language-restriction policy consistently and to minimize potential selection bias. In addition, intervention classification was independently reviewed by two investigators during data extraction. Any disagreements regarding node assignment, particularly for borderline or multicomponent programs, were resolved through discussion and consensus.

Risk of bias assessment

Risk of bias for the included RCTs was independently assessed by two authors (Y.W. and Z.L.) using the Cochrane Risk of Bias tool version 2.0 (RoB 2, 2019). Five domains were evaluated: (1) bias arising from the randomization process, (2) bias due to deviations from intended interventions, (3) bias due to missing outcome data, (4) bias in measurement of the outcome, and (5) bias in selection of the reported result. Each domain was rated as low risk, some concerns, or high risk according to RoB 2 guidance. Overall risk was judged as high risk if any domain was rated high, some concerns if at least one domain raised concerns but none was rated high, and low risk if all domains were rated low. Disagreements were resolved through discussion and consensus. Inter-rater agreement was quantified using Cohen's kappa, which was 0.83, indicating substantial agreement.

Outcome hierarchy and handling of multiplicity

Outcomes were pre-specified hierarchically. The co-primary outcomes were sprint performance (5, 20, 30, and 40 m) and vertical jump height (SJ and CMJ), as these outcomes most directly reflect the sport-relevant explosive capacities targeted by the included interventions. Secondary outcomes were change-of-direction (COD) performance and maximal strength (1RM), which were included to complement the interpretation of neuromuscular adaptation and training transfer.

Because the review synthesized multiple related outcomes, we pre-specified that the primary interpretation of comparative effectiveness would be based on the co-primary outcomes only. Secondary outcomes were considered supportive rather than primary evidence. No formal multiplicity adjustment across outcomes was applied, because the outcomes were analyzed in separate outcome-specific network meta-analyses and the review was primarily intended to compare patterns of effectiveness across performance domains rather than to test a single family-wise confirmatory hypothesis. Accordingly, findings for COD and 1RM were interpreted cautiously and were not used to make primary effectiveness claims.

Data analysis

For quantitative synthesis, post-intervention means and standard deviations were extracted for all outcomes. Outcome units were standardized before analysis, and the units used for each outcome together with the interpretation of effect direction are summarized in Table 2. Sprint performance was analyzed as time in seconds for the 5, 20, 30,

and 40-m tests, with lower values indicating better performance; therefore, negative MDs favored the intervention group. Vertical jump performance was analyzed as jump height in centimeters for SJ and CMJ, with higher values indicating better performance; therefore, positive MDs favored the intervention group. COD performance was analyzed as movement speed in meters per second, with higher values indicating better performance; therefore, positive MDs favored the intervention group. Maximal strength was analyzed as 1RM in kilograms, with higher values indicating better performance; therefore, positive MDs favored the intervention group. To maximize comparability across intervention nodes and study designs, outcome data were extracted from assessments conducted immediately after completion of the intervention. This time point was prioritized because it was consistently available across the included randomized controlled trials and most directly reflected the short-term effect of the assigned training

modality. No longer-term follow-up data were available in the included trials; therefore, the present network meta-analysis was restricted to immediate post-intervention effects and could not evaluate the durability of training-induced adaptations. Because the validity of the network depends partly on the comparability of interventions within each node, the intervention taxonomy and node assignments were finalized before model fitting using the pre-specified operational criteria described in Section 2.2. When only change-from-baseline scores were reported, post-intervention values were calculated according to the Cochrane Handbook, and when SDs were missing, they were estimated from standard errors or confidence intervals. All randomized controlled trials (RCTs) included in the network meta-analysis had independent control groups. Therefore, each contrast was treated as statistically independent, and no adjustment for shared comparators was required.

Table 2. Summary of comparative effects of each training modality versus regular training across performance outcomes.

Outcome	Modality	MD vs Regular Training (95% CI)	SUCRA (%)	Interpretation
5-m sprint	Traditional Strength Training	-0.09 (-0.11, -0.07)	99.8	Significant benefit
5-m sprint	Speed Training	-0.07 (-0.10, -0.04)	66.5	Significant benefit
5-m sprint	Plyometric Jump Training	-0.03 (-0.06, -0.00)	33.4	Marginal/significant benefit
5-m sprint	Regular Training	Reference	0.3	Reference
20-m sprint	Traditional Strength Training	-0.13 (-0.20, -0.06)	89.9	Significant benefit
20-m sprint	Speed Training	-0.10 (-0.16, -0.03)	73.2	Significant benefit
20-m sprint	Endurance Training	-0.07 (-0.23, 0.10)	49.9	No clear difference
20-m sprint	Flexibility Training	-0.04 (-0.16, 0.08)	37.9	No clear difference
20-m sprint	Plyometric Jump Training	-0.04 (-0.11, 0.02)	37.4	No clear difference
20-m sprint	Regular Training	Reference	11.7	Reference
30-m sprint	Speed Training	-0.16 (-0.34, 0.01)	74.2	No clear difference
30-m sprint	Plyometric Jump Training	-0.14 (-0.30, 0.02)	65.2	No clear difference
30-m sprint	Traditional Strength Training	-0.13 (-0.25, -0.01)	64.8	Significant benefit
30-m sprint	Endurance Training	-0.14 (-0.45, 0.16)	63.0	No clear difference
30-m sprint	Regular Training	Reference	18.7	Reference
30-m sprint	Flexibility Training	0.04 (-0.17, 0.25)	14.1	No clear difference
40-m sprint	Endurance Training	-0.21 (-0.45, 0.03)	74.1	No clear difference
40-m sprint	Speed Training	-0.20 (-0.48, 0.08)	69.6	No clear difference
40-m sprint	Traditional Strength Training	-0.13 (-0.26, 0.00)	51.5	No clear difference
40-m sprint	Regular Training	Reference	4.9	Reference
SJ	Traditional Strength Training	4.40 (2.07, 6.74)	86.2	Significant benefit
SJ	Speed Training	3.07 (0.65, 5.50)	56.3	Significant benefit
SJ	Plyometric Jump Training	2.96 (-0.83, 6.75)	55.2	No clear difference
SJ	Regular Training	Reference	2.3	Reference
CMJ	Traditional Strength Training	3.58 (2.00, 5.15)	73.0	Significant benefit
CMJ	Plyometric Jump Training	3.41 (1.72, 5.09)	67.8	Significant benefit
CMJ	Endurance Training	3.30 (0.41, 6.19)	61.4	Significant benefit
CMJ	Flexibility Training	3.01 (1.45, 4.57)	52.2	Significant benefit
CMJ	Speed Training	2.83 (1.10, 4.55)	45.3	Significant benefit
CMJ	Regular Training	Reference	0.3	Reference
COD	Traditional Strength Training	0.13 (0.08, 0.18)	83.8	Significant benefit
COD	Plyometric Jump Training	0.13 (0.05, 0.21)	81.4	Significant benefit
COD	Speed Training	0.11 (0.06, 0.16)	44.8	Significant benefit
COD	Flexibility Training	0.05 (-0.01, 0.11)	24.3	No clear difference
COD	Regular Training	Reference	1.9	Reference
1RM	Traditional Strength Training	20.86 (10.73, 30.98)	99.2	Significant benefit
1RM	Speed Training	5.74 (-9.15, 20.63)	54.3	No clear difference
1RM	Regular Training	Reference	28.2	Reference
1RM	Flexibility Training	2.42 (-11.89, 16.74)	18.3	No clear difference

MD = mean difference; CI = confidence interval; SUCRA = surface under the cumulative ranking curve; SJ = squat jump; CMJ = countermovement jump; COD = change of direction; 1RM = one-repetition maximum. Regular Training was used as the reference comparator. Sprint outcomes (5-m, 20-m, 30-m, and 40-m) were analyzed as time in seconds (s), and negative MD values indicate better performance. SJ and CMJ were analyzed as jump height in centimeters (cm), COD was analyzed as movement speed in meters per second (m/s), and 1RM was analyzed in kilograms (kg); for these outcomes, positive MD values indicate better performance.

A frequentist random-effects network meta-analysis was conducted using the Stata network suite (version 15.1), with standard errors and 95% confidence intervals estimated for all comparisons. Between-study heterogeneity was estimated separately for each outcome-specific network, assuming a common between-study variance (τ^2) across treatment comparisons within each network and estimating it using restricted maximum likelihood (REML). All performance metrics were converted to standardized native units: seconds (s) for sprint outcomes, centimeters (cm) for SJ and CMJ, meters per second (m/s) for COD, and kilograms (kg) for 1RM. Because sprint, jump, COD, and 1RM outcomes were reported in interpretable native units, MDs were retained as the primary effect measure. However, for sprint outcomes, identical units do not necessarily imply full measurement commensurability across studies, because timing method, start procedure, and test surface varied. Therefore, sprint testing characteristics were extracted for the studies contributing sprint outcomes and summarized in Supplementary Table S32, and an additional timing-method sensitivity analysis was conducted to examine the robustness of the sprint findings (Supplementary Table S33).

To improve interpretation of between-study heterogeneity and the likely range of effects in future studies, we additionally report the estimated τ^2 for each outcome-specific network and, where informative, 95% prediction intervals for key contrasts (Supplementary Table S31). To evaluate the potential impact of effect modifiers and to further examine the plausibility of the transitivity assumption, we conducted pre-specified network meta-regression analyses for several participant characteristics, including sex, age, maturation, playing standard, season phase, and baseline ability. These analyses are reported in Supplementary Table S28. All meta-regression analyses were performed as separate univariable models, with one covariate entered at a time. No multivariable meta-regression models were fitted. Therefore, the analyses did not involve simultaneous inclusion of multiple covariates in the same model, which reduced concerns regarding collinearity. Because each model included only one covariate, this strategy was also adopted to minimize the risk of overfitting, particularly in sparse outcome networks. In addition, all covariate data used in the meta-regression analyses were complete; therefore, no imputation procedures were required and no studies were excluded because of missing covariate data. Given the limited number of studies in some outcome networks, these meta-regression findings were interpreted cautiously as exploratory rather than confirmatory. Consistency was assessed using both global and local approaches. Global inconsistency was examined with the design-by-treatment interaction model, whereas local inconsistency was assessed using node-splitting (Supplementary Table S30). Because a non-significant node-splitting p-value does not establish consistency, particularly in sparse loops with limited statistical power, these tests were interpreted together with the magnitude of inconsistency factors and the width of their 95% confidence intervals. Therefore, consistency was judged cautiously as the absence of important detected disagreement between direct and indirect evidence, rather than as proof of exact agreement. Interventions were

ranked using Surface Under the Cumulative Ranking (SUCRA) probabilities (0 - 100%). Small-study effects and potential publication bias were assessed at the outcome-network level rather than using comparison-adjusted funnel plots. Because several treatment loops in the present network were sparse, comparison-adjusted funnel plots were not prespecified for the primary assessment. Instead, for outcome networks including at least 10 studies, conventional funnel-plot asymmetry and Egger's linear regression test were examined; Begg's rank correlation test was additionally reported as a supportive analysis. For outcome networks with fewer than 10 studies, no formal statistical test was interpreted because such tests have limited power and may be misleading in sparse evidence structures. To pre-specify how these signals informed certainty of evidence, suspected small-study effects or publication bias were considered in the CINeMA reporting-bias domain and could contribute to downgrading certainty for the affected outcome/comparisons. In sparse networks, absence of statistical significance was not interpreted as evidence of absence of publication bias. In addition, sensitivity analyses were performed for all outcome-specific networks using leave-one-study-out influence diagnostics and outlier checks to examine the robustness of the pooled estimates. Where small-study effects were suspected, these findings were also considered when interpreting the stability of the results and when judging certainty of evidence.

Results

Study identification and selection

A systematic search across the electronic databases PubMed, Embase, the Cochrane Library, Web of Science, and SPORTDiscus yielded 6,546 records. SPORTDiscus was included to improve retrieval of sports-specific literature not consistently indexed in broader biomedical databases. After removal of 1,012 duplicates, 5,534 records underwent title and abstract screening, of which 5,217 were excluded. Of the 317 reports sought for retrieval, 3 were unavailable. The remaining 314 full-text articles were assessed for eligibility, and 283 reports were excluded because of absence of a control group ($n = 108$), missing critical outcome data ($n = 52$), unmatched intervention protocols ($n = 58$), or ineligible publication formats such as reviews, case reports, or conference abstracts ($n = 65$). Ultimately, 31 randomized controlled trials (RCTs) met the eligibility criteria and were included in the final network meta-analysis (Figure 1).

Quality assessment of the included studies

Risk of bias was assessed using the Cochrane RoB 2 tool. Of the 31 included studies, 10 were judged as low risk, 18 as some concerns, and 3 as high risk. These ratings informed the within-study bias domain in the subsequent certainty-of-evidence assessment. Given the nature of exercise intervention research, complete blinding of participants and personnel was often not feasible, largely because informed consent and direct participation in specialized training programs are inherently difficult to mask. A detailed summary of the risk-of-bias assessments is shown in Supplementary Figure S1, and comprehensive evidence profiles are provided in Supplementary Tables S20 - S27.

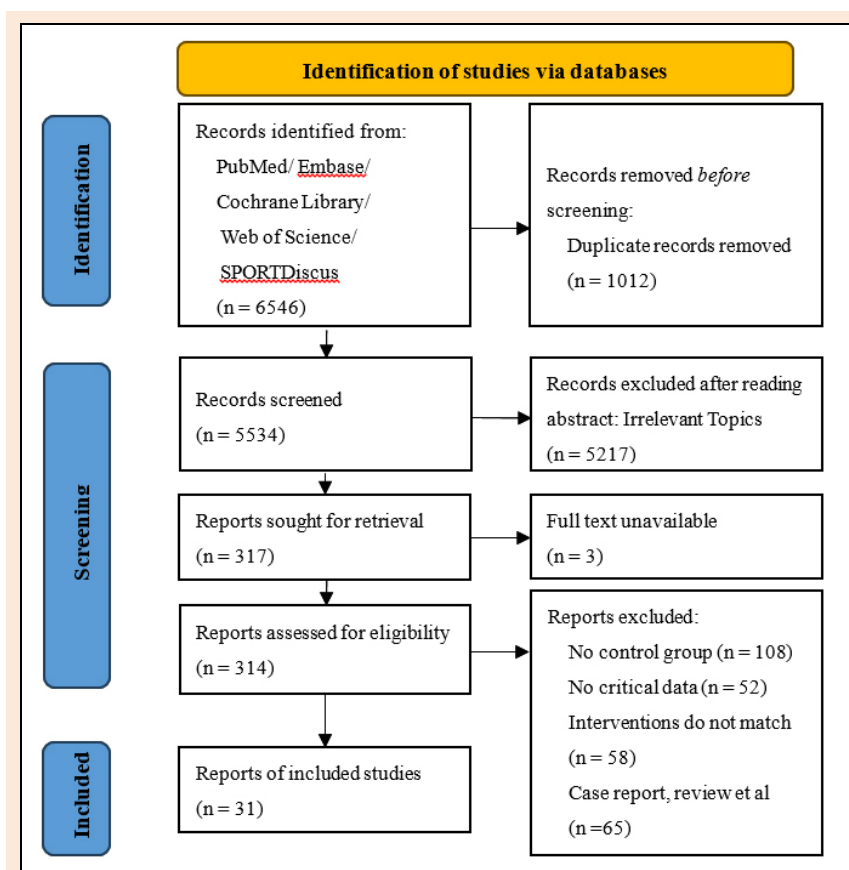


Figure 1. Flow diagram of literature selection.

Characteristics of the included studies

The 31 included RCTs involved soccer players as the primary participant population. The evidence base was composed predominantly of male professional or academy-level players, whereas women's soccer and other playing levels were not meaningfully represented in the eligible trials. These studies compared six distinct training modalities: Traditional Strength Training, Plyometric Jump Training, Speed Training, Endurance Training, Flexibility Training, and Regular Training. The evaluated outcomes focused on linear sprint performance (5 m to 40 m distance), vertical jump height (Squat Jump and Countermovement Jump), maximal strength (1RM), and change-of-direction (COD) performance. The intervention durations across the studies ranged from 1 to 16 weeks. All included studies were published in English. Further study characteristics are summarized in Supplementary Table S2. For studies contributing sprint outcomes, testing characteristics relevant to measurement comparability were additionally summarized in Supplementary Table S32. Most studies used electronic/photoelectric timing systems, whereas a minority used video/app-based methods or did not clearly report the timing method; start procedures and running surfaces also varied across studies.

Network meta-analysis

Consistency was evaluated using both local node-splitting analyses and the global design-by-treatment interaction model. Local inconsistency factors were generally small across outcome-specific loops, although 95% confidence intervals were often wide in sparse parts of the network

(Supplementary Tables S3 - S10). Accordingly, node-splitting P-values were not interpreted in isolation; instead, consistency was judged cautiously by considering the magnitude and precision of local inconsistency estimates together with the global inconsistency results. Several local loops were sparse, particularly in the 30-m and 40-m sprint networks and in comparisons involving Flexibility Training or Endurance Training. At the global level, the design-by-treatment interaction model did not detect important inconsistency, but this finding should be interpreted as supportive rather than confirmatory. Exploratory network meta-regression analyses based on separate univariable models (Supplementary Table S28) suggested that baseline ability and maturation modified effects in several outcomes ($P < 0.05$), whereas playing standard and season phase did not significantly modify effects in the 5-m and 20-m sprint networks. In addition, the network meta-regression analysis of training dosage modifiers (Supplementary Table S29) showed no significant interaction for training frequency, session duration, or intervention duration across the eight performance outcomes (all $P \geq 0.05$). Overall, these findings support, but do not establish, the plausibility of transitivity and should be interpreted cautiously, particularly in sparse outcome networks. Additional information on between-study heterogeneity and prediction intervals is provided in Supplementary Table S31.

Primary outcomes

5 m Sprint Test

In the 5 m sprint test, expressed as time in seconds (s), Traditional Strength Training ranked highest by SUCRA

(99.8%; Figure 2B) and showed the most favorable effect for enhancing initial acceleration. Speed Training ranked second (SUCRA = 66.5%) and showed a statistically significant improvement over Regular Training (MD = -0.07 s, 95% CI: -0.10 to -0.04; Supplementary Table S11). Traditional Strength Training also demonstrated a statistically significant improvement over Regular Training (MD = -0.09 s, 95% CI: -0.11 to -0.07; Supplementary Table S11). Plyometric Jump Training ranked third (SUCRA = 33.4%), whereas Regular Training ranked lowest by SUCRA (0.3%).

20 m Sprint Test

Network results for the 20 m sprint, expressed as time in seconds (s), revealed that Traditional Strength Training had the highest probability of effectiveness (SUCRA = 89.9%; Figure 3B). Traditional Strength Training demonstrated a statistically significant improvement over Regular Training (MD = -0.13 s, 95% CI: -0.20 to -0.06; Supplementary Table S12). Speed Training ranked second (SUCRA = 73.2%) and also showed a favorable effect compared with Regular Training (MD = -0.10 s, 95% CI: -0.16 to -0.03; Supplementary Table S12). Endurance Training (SUCRA = 49.9%) and Flexibility Training (SUCRA = 37.9%) ranked lower, and Regular Training remained the least effective intervention (SUCRA = 11.7%).

30 m Sprint Test

For the 30 m sprint test, expressed as time in seconds (s), the hierarchy of effectiveness shifted toward velocity-

specific and reactive modalities (Figure 4B). Speed Training achieved the highest SUCRA (74.2%), followed by Plyometric Jump Training (65.2%) and Traditional Strength Training (64.8%). Endurance Training also showed substantial efficacy (SUCRA = 63.0%). In contrast, Regular Training (SUCRA = 18.7%) and Flexibility Training (SUCRA = 14.1%) were positioned at the bottom of the ranking. However, the principal contrast between Speed Training and Regular Training did not reach statistical significance (MD = -0.16 s, 95% CI: -0.34 to 0.01; Supplementary Table S13), so this ranking should not be interpreted as definitive evidence of superiority.

40 m Sprint Test

Regarding the 40 m sprint, expressed as time in seconds (s), no training intervention demonstrated a statistically significant improvement compared with Regular Training. Although Endurance Training achieved the highest SUCRA (74.1%), the principal contrast with Regular Training was not statistically significant (MD = -0.21 s, 95% CI: -0.45 to 0.03; Supplementary Table S14). Speed Training (SUCRA = 69.6%) and Traditional Strength Training (SUCRA = 51.5%) ranked next, but the cumulative ranking curves (Figure 5B) should be interpreted with caution. In the absence of clear between-intervention differences, these rankings reflect substantial statistical uncertainty rather than a definitive hierarchy of effectiveness. Regular Training was again the least effective modality (SUCRA = 4.9%).

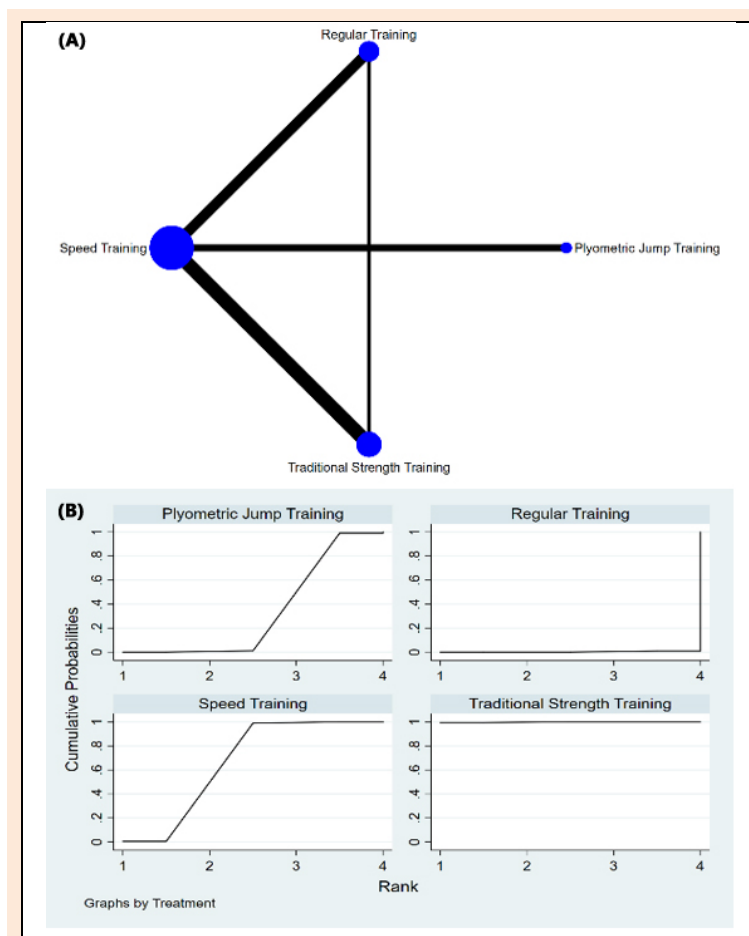


Figure 2. (A) NMA figure for 5 m sprint performance; (B) SUCRA plot for 5 m sprint performance.

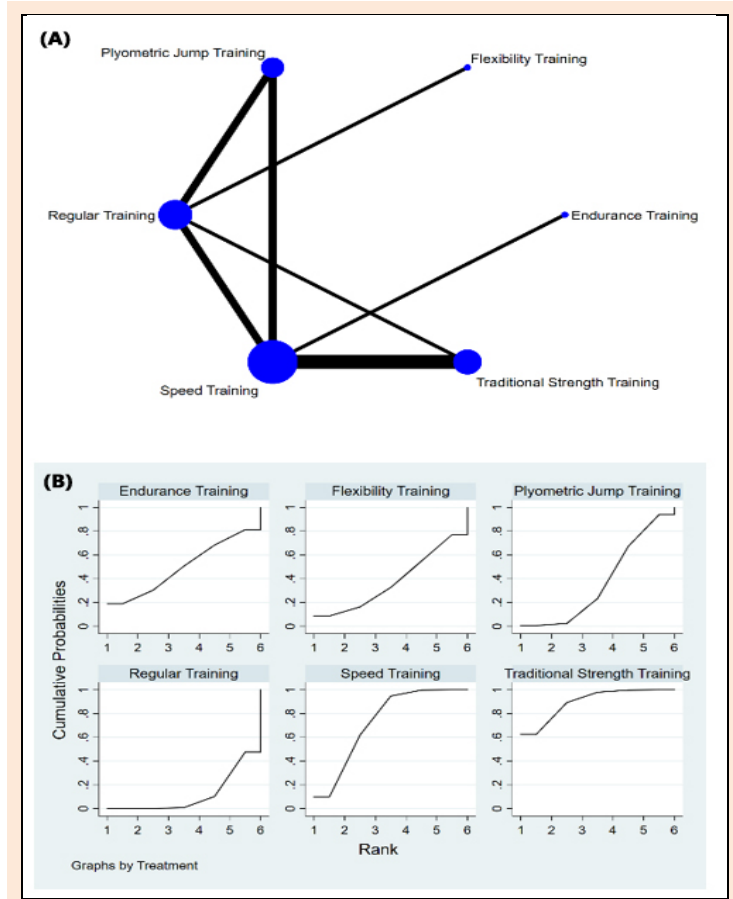


Figure 3. (A) NMA figure for 20 m sprint performance; (B) SUCRA plot for 20 m sprint performance.

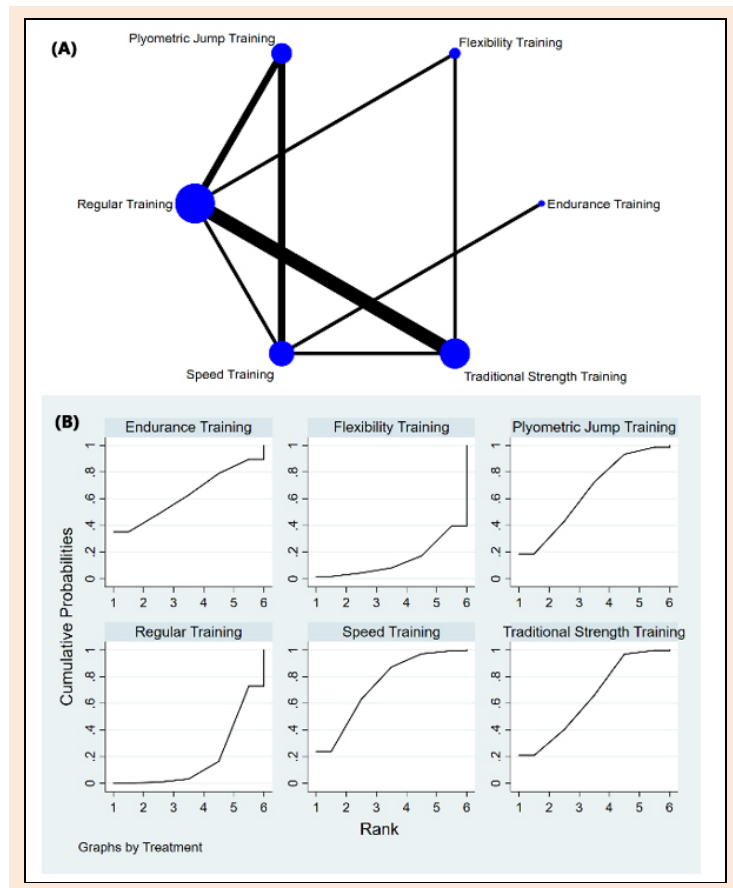


Figure 4. (A) NMA figure for 30 m sprint performance; (B) SUCRA plot for 30 m sprint performance.

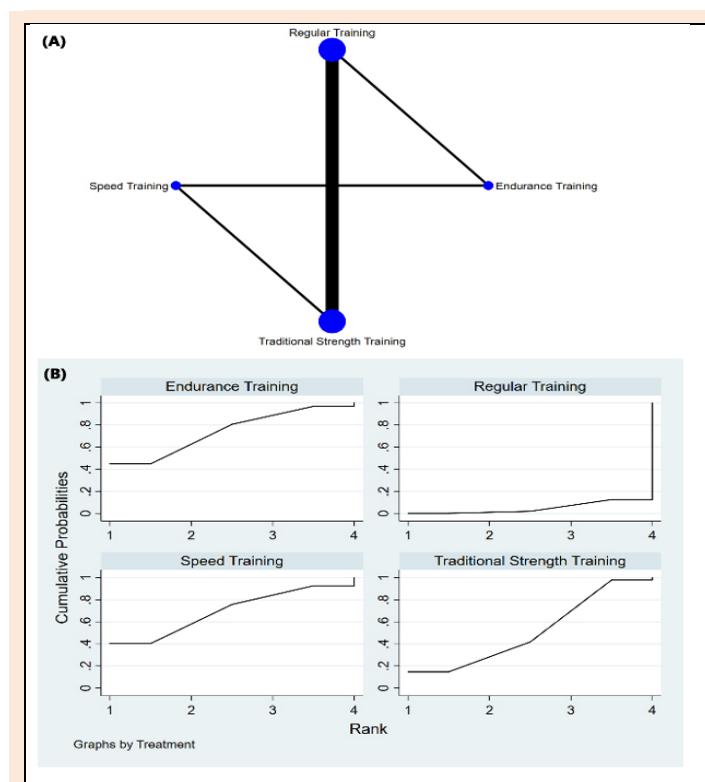


Figure 5. (A) NMA figure for 40 m sprint performance; (B) SUCRA plot for 40 m sprint performance.

Squat Jump (SJ) Test

In the SJ test, expressed as jump height in centimeters (cm), Traditional Strength Training demonstrated the most favorable outcomes (SUCRA = 86.2%; Figure 6B) and showed a significant improvement over Regular Training (MD = 4.40 cm, 95% CI: 2.07 to 6.74; Supplementary Table S15). Speed Training (SUCRA = 56.3%) and Plyometric Jump Training (SUCRA = 55.2%) ranked next and showed broadly similar SUCRA profiles, whereas Regular Training ranked lowest by SUCRA (2.3%).

Countermovement Jump (CMJ) Test

In the CMJ test, expressed as jump height in centimeters (cm), Traditional Strength Training maintained its superiority and ranked highest by SUCRA (73.0%; Figure 7B). This was followed by Plyometric Jump Training (SUCRA = 67.8%) and Endurance Training (SUCRA = 61.4%). Traditional Strength Training showed the most beneficial effect compared with Regular Training (MD = 3.58 cm, 95% CI: 2.00 to 5.15; Supplementary Table S16). Regular Training ranked lowest by SUCRA (0.3%).

Secondary Outcomes

Change-of-Direction (COD) Test

In the COD test, expressed as movement speed in meters per second (m/s), Traditional Strength Training (SUCRA = 83.8%) and Plyometric Jump Training (SUCRA = 81.4%) ranked highest by SUCRA, as illustrated in Figure 8B. Traditional Strength Training demonstrated superior results compared with Regular Training (MD = 0.13 m/s, 95% CI: 0.08 to 0.18; Supplementary Table S17). Conversely, Regular Training (SUCRA = 1.9%) and Flexibility Training (SUCRA = 24.3%) were the least effective for enhancing COD performance. For this outcome, positive MD values

indicate better performance.

1RM Strength Test

In the 1RM test, expressed in kilograms (kg), Traditional Strength Training ranked highest for maximal strength (SUCRA = 99.2%; Figure 9B). It showed clear advantages over Speed Training (MD = 15.12 kg, 95% CI: 0.22 to 30.02) and Regular Training (MD = 20.86 kg, 95% CI: 10.73 to 30.98; Supplementary Table S18). Speed Training (SUCRA = 54.3%) and Regular Training (SUCRA = 28.2%) ranked lower, while Flexibility Training was ranked last (SUCRA = 18.3%).

Forest plot of the network meta-analysis for all eight outcomes were given at Supplementary Figures S2 – S9.

Publication Bias Test

To evaluate potential small-study effects and publication bias, we assessed outcome-specific funnel-plot asymmetry rather than using comparison-adjusted funnel plots, because several treatment loops in the network were sparse. For outcome networks with at least 10 studies, conventional funnel plots were visually inspected and Egger's linear regression test was applied; Begg's rank correlation test was reported as a supportive analysis. As shown in Figure 10 and Supplementary Table S19, no statistically significant small-study effects were detected for most outcomes. However, for 1RM strength, Egger's test suggested possible small-study effects ($P = 0.009$). For the 40-m sprint outcome (8 studies), formal interpretation of funnel-based statistical testing was considered limited because of the small number of included studies. These signals were incorporated cautiously into the certainty-of-evidence assessment and were not interpreted in isolation from imprecision and network sparsity.

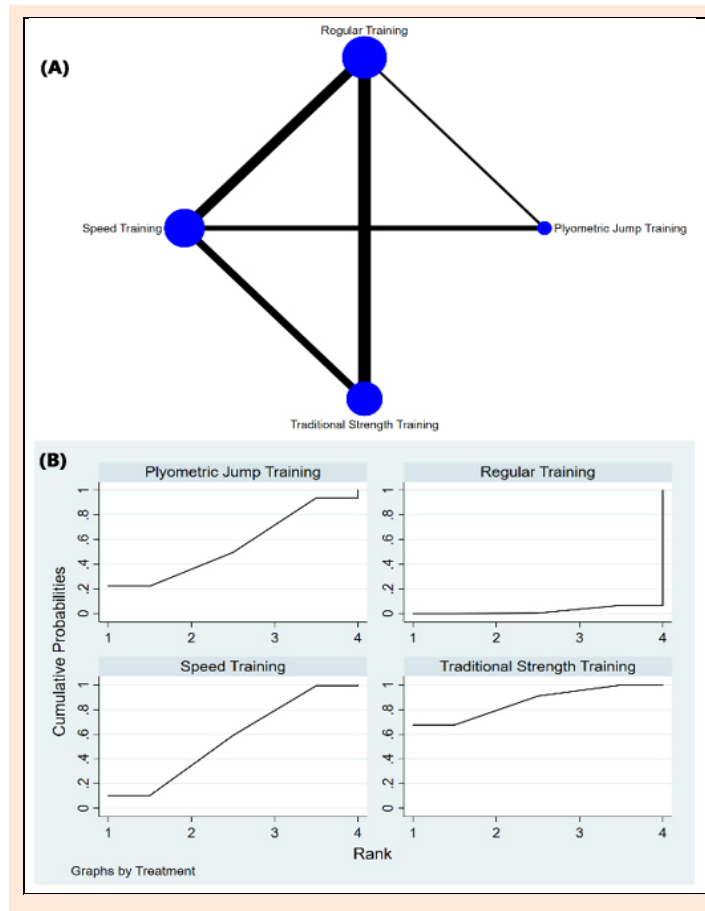


Figure 6. (A) NMA figure for squat jump (SJ) performance; (B) SUCRA plot for squat jump (SJ) performance.

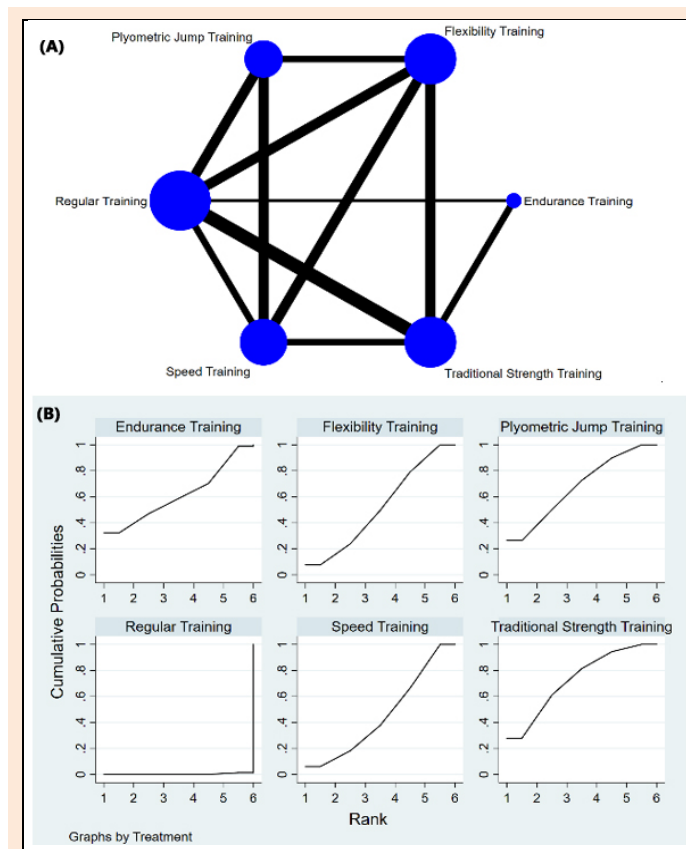


Figure 7. (A) NMA figure for countermovement jump (CMJ) performance; (B) SUCRA plot for countermovement jump (CMJ) performance.

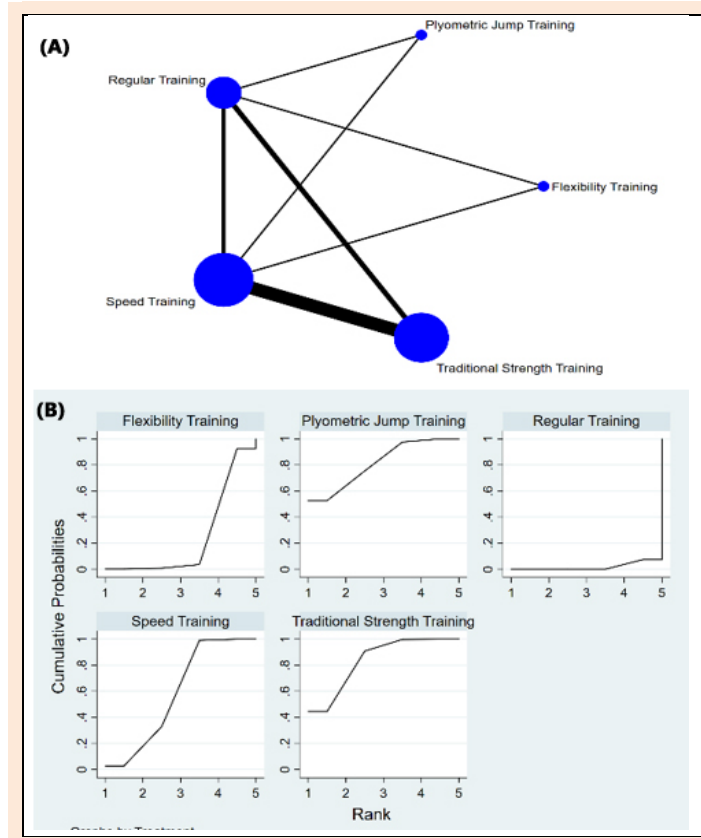


Figure 8. (A) NMA figure for change-of-direction (COD) performance; (B) SUCRA plot for change-of-direction (COD) performance.

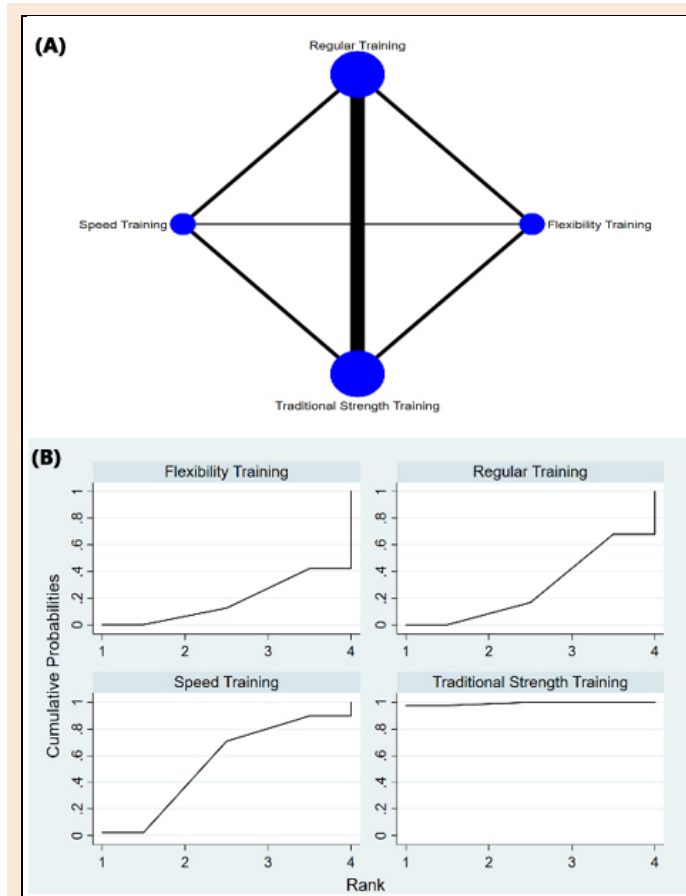


Figure 9. (A) NMA figure for one-repetition maximum (1RM); (B) SUCRA plot for one-repetition maximum (1RM).

Sensitivity analyses

Sensitivity analyses were conducted for all eight outcomes using leave-one-study-out influence diagnostics and outlier checks (Supplementary Figures S10 - S17). Overall, omission of any single study did not materially alter the direction or general pattern of the pooled estimates across the outcome networks. However, the magnitude of the pooled effect appeared less stable for 1RM than for the co-primary sprint and jump outcomes, indicating that this secondary outcome should be interpreted more cautiously. This interpretation was further supported by the finding of possible small-study effects for 1RM in Egger's test. For sprint outcomes, an additional timing-method sensitivity analysis was performed by excluding studies that used video/app-based timing methods, while retaining studies with unclear timing-method reporting to avoid excessive fragmentation of sparse networks (Supplementary Table S33). The key findings for the 5-m and 20-m sprint outcomes were materially unchanged after this restriction, whereas the 30-m and 40-m results remained directionally similar but imprecise. These results suggest that the main sprint conclusions were not driven solely by the inclusion of non-photoelectric/electronic timing methods.

Discussion

This network meta-analysis evaluated the comparative effectiveness of six training modalities on the athletic performance of soccer players, acknowledging that in practice these methods are typically embedded within concurrent and multi-modal training systems (Enright et al., 2015; Morgans et al., 2014). Our findings suggest a performance-specific pattern of comparative effectiveness across outcomes, although the hierarchy for longer sprint distances, particularly 40 m, remained uncertain (Marshall et al., 2021; Oliver et al., 2024).

Initial acceleration and short-sprint dominance (5 m and 20 m)

In the analysis of 5 m sprint performance, which represents the initial acceleration phase, Traditional Strength Training demonstrated a statistically significant benefit compared with Regular Training (MD = -0.09 s, 95% CI: -0.11 to -0.07) and ranked highest across the network. With a SUCRA value of 99.8%, it was identified as the most effective intervention for enhancing initial acceleration (Seitz et al., 2014; Skratek et al., 2024). This finding aligns with the mechanical imperatives of starting from a stationary position, where overcoming inertia requires maximal force production (Cormie et al., 2011a; Loturco et al., 2020). High-load resistance training is theorized to facilitate these improvements, potentially by enhancing the rate of force development (RFD), which is critical during the explosive push-off phase of a sprint start (Brumitt and Cuddeford, 2015; Suchomel et al., 2016). Galantine et al. (2025) found that take-off velocity in ballistic lower limb tests strongly correlates with sprint acceleration, further supporting the link between force capacity and early-stage sprinting. Furthermore, the neural adaptations typically associated with strength training—including enhanced motor unit recruitment and firing frequency—may provide a plausible physiological foundation for the predominant

concentric muscle actions required during the first few steps (Kim et al., 2019; Santos et al., 2023).

Notably, the present network meta-analysis reveals that Traditional Strength Training maintains its top-ranked position for 20 m sprint performance (SUCRA = 89.9%), significantly outperforming Regular Training (MD = -0.13 s, 95% CI: -0.20 to -0.06). This result suggests that within the context of soccer-specific distances, the capacity to generate maximal ground reaction forces (GRF) likely remains a decisive driver of performance throughout the mid-acceleration phase (Hunter et al., 2005; Nagahara et al., 2018). Traditional Strength Training not only provides a structural basis via potential increases in muscle cross-sectional area but may also optimize neuromechanical efficiency, allowing athletes to apply higher impulses within extremely short ground contact times (Blazevich et al., 2007; Cormie et al., 2011b). This interpretation is also consistent with the broader resistance-training literature showing that program structure and exercise mode can influence strength, hypertrophy, and sprint/jump transfer (De Souza et al., 2018; Egan and Sharples, 2023; Ferrete et al., 2014; García-Valverde et al., 2022; Zhang et al., 2022). Consequently, for soccer players aiming to enhance their explosive break-away ability over the first 20 meters, establishing a foundation of maximal lower-body strength appears to be a primary focus of physical development (Keiner et al., 2022; Loturco et al., 2015).

Distance-specific transition toward higher sprint velocity (30 m and 40 m)

At 30 m, Speed Training ranked highest by SUCRA; however, the corresponding comparison with Regular Training was imprecise and crossed the null. Therefore, these findings are more appropriately interpreted as a trend rather than definitive evidence of superiority. Any interpretation beyond the observed ranking pattern should be considered an extrapolation rather than a direct finding of the present synthesis. Although sprint performance over this distance may plausibly reflect the transition from acceleration toward higher running velocities, the current evidence does not establish a clear between-intervention advantage. In addition, this outcome should be interpreted in light of methodological variation across studies, including differences in starting stance, timing systems, and running surfaces, all of which may influence whether a given sprint distance reflects primarily acceleration or top-end speed (Haugen et al., 2019a).

At 40 m, Endurance Training had the highest SUCRA value; however, no intervention was statistically superior to Regular Training. Therefore, the apparent 40 m ranking should not be interpreted as a reliable hierarchy of comparative effectiveness. Any interpretation beyond this result should be considered an extrapolation rather than a finding directly supported by the present synthesis. In addition, the Endurance Training node included heterogeneous interventions primarily targeting metabolic conditioning, rather than a uniform set of methods specifically designed to improve isolated single-bout 40 m sprint performance. In particular, phosphocreatine resynthesis is more relevant to recovery between repeated sprint bouts than to the time achieved in a single maximal 30 - 40 m sprint.

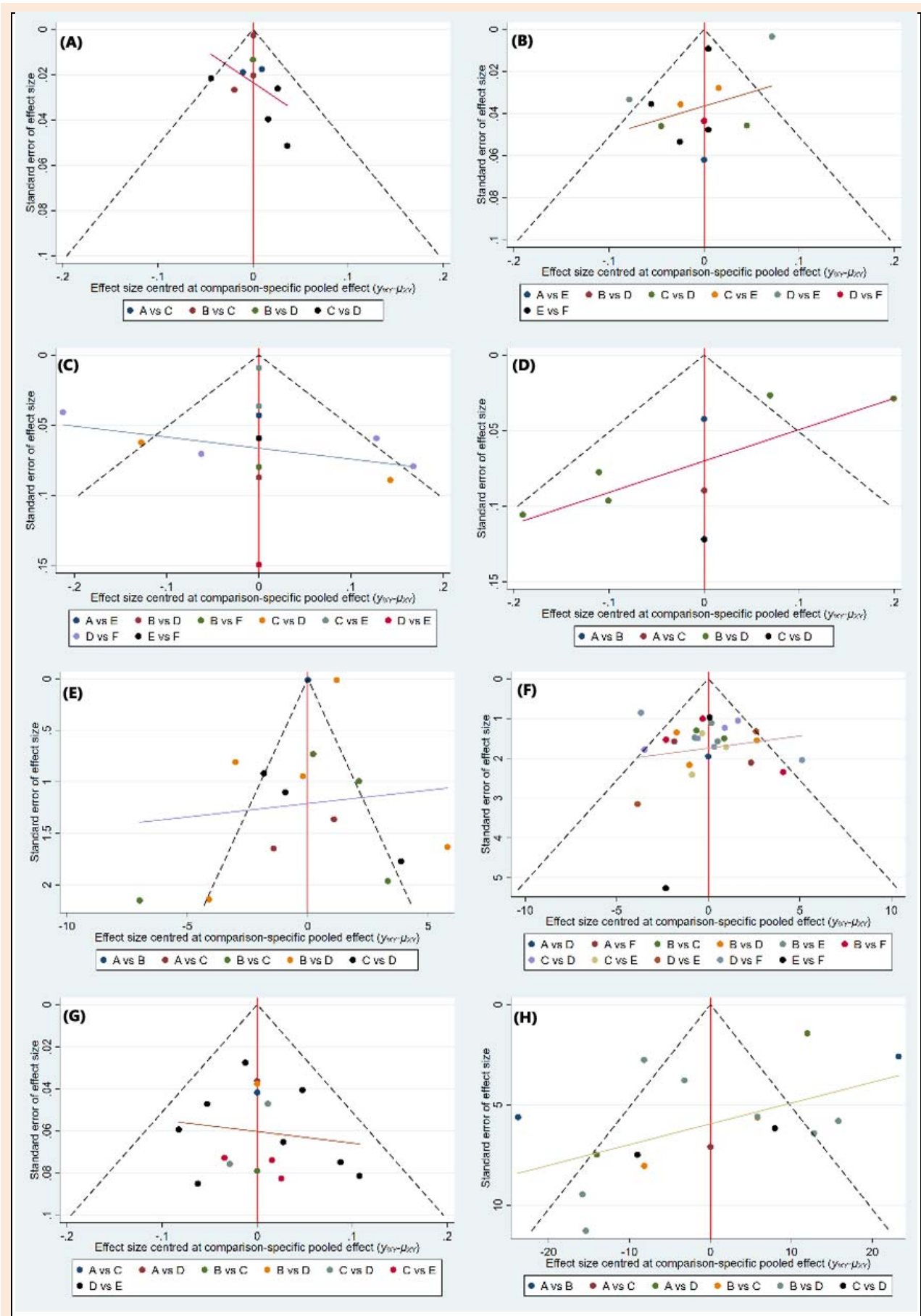


Figure 10. Funnel plot of publication bias. (A) 5 m sprint; (B) 20 m sprint; (C) 30 m sprint; (D) 40 m sprint; (E) SJ test; (F) CMJ test; (G) COD test; (H) IRM test.

Accordingly, any apparent advantage of endurance-oriented interventions for 40 m performance should be interpreted as indirect, modest, and hypothesis-generating rather than as evidence of a primary mechanistic role. Although 40 m sprint performance may plausibly reflect the transition toward maximal velocity, the current evidence does not demonstrate that endurance-oriented training improves this outcome in soccer players. At most, this pattern may be regarded as hypothesis-generating and should be interpreted cautiously, particularly because medium- to long-distance sprint performance reflects an interaction of maximal-velocity mechanics and speed-endurance qualities rather than a simple extension of early acceleration alone (Brocherie et al., 2016; Nicholson et al., 2022; Rakovic et al., 2018; Shalfawi et al., 2012; Maciel et al., 2024).

Vertical power and the role of the stretch-shortening cycle (SJ and CMJ)

Traditional Strength Training was also the most effective modality for both the SJ and CMJ, reinforcing the importance of maximal-force capacity for vertical power production. This finding is consistent with evidence that high-load resistance training improves force output through both neural and morphological adaptations, including enhanced motor unit recruitment and changes in muscle architecture that may support concentric impulse generation (Blazevich et al., 2007; Gouveia et al., 2023; Mirzayev, 2017). At the same time, Plyometric Jump Training ranked particularly well for the CMJ, which is mechanically plausible because the CMJ relies more strongly on effective stretch-shortening cycle utilization than the SJ. The near-equivalent efficacy of strength- and plyometric-oriented approaches for CMJ performance suggests that both maximal-force development and reactive-strength enhancement contribute meaningfully to vertical explosive capacity in soccer players (Lamas et al., 2012; Ramírez-de-laCruz et al., 2022; Rønnestad et al., 2008).

Secondary outcomes (COD and 1RM)

As pre-specified secondary outcomes, COD and 1RM were interpreted as supportive rather than primary evidence and were not used to define the principal comparative conclusions of this review. Traditional Strength Training (MD = 0.13 m/s compared with Regular Training, 95% CI: 0.08 to 0.18) and Plyometric Jump Training (MD = 0.13 m/s compared with Regular Training, 95% CI: 0.05 to 0.21) demonstrated significant and comparable efficacy for enhancing COD performance (Nygaard Falch et al., 2019; Pardos et al., 2024). This pattern is reasonable because COD performance depends on both braking capacity and rapid re-acceleration, which may be supported by force-oriented and reactive-strength adaptations. However, the included COD tests were predominantly planned, closed-skill tasks, so the findings are more likely to reflect improvements in mechanical change-of-direction capacity than in full reactive agility.

Therefore, the observed effectiveness of strength and plyometric training likely stems from improvements in foundational mechanical factors—such as eccentric leg stiffness, braking capacity, and reactive strength—which

are paramount for managing high approach velocities during sharp turns. However, the extent to which these gains transfer to reactive agility should not be assumed to be complete. In applied soccer settings, reactive agility requires not only the physical ability to decelerate and re-accelerate, but also the perceptual-cognitive capacity to detect, interpret, and respond to evolving external cues such as opponent movement, ball trajectory, and game context. Accordingly, improvements in planned COD performance may provide an important physical foundation for reactive agility, particularly by increasing the movement options available once a decision has been made, but they may not fully translate to match-play agility where integrated perceptual-decision training or sport-specific open-skill practice is required. This distinction is important when interpreting the present COD findings, because the observed benefits are likely to reflect enhancement of the mechanical component of directional change rather than the full reactive agility construct (Secomb et al., 2015; Spiteri et al., 2014).

Regarding maximal strength, Traditional Strength Training ranked highest and showed a favorable effect compared with Regular Training. However, because 1RM was a pre-specified secondary outcome and the sensitivity analyses suggested less stable effect estimates than for the co-primary outcomes, this finding should be interpreted as supportive rather than definitive. In addition, possible small-study effects were detected for 1RM, further reducing confidence in the apparent magnitude of benefit.

Practical applications

Based on the SUCRA hierarchies and effect sizes established in this study, several practical implications may be considered. However, it is imperative to acknowledge that in applied soccer environments, these training modalities are rarely implemented in isolation. Instead, they are typically integrated into a concurrent training framework alongside technical-tactical sessions and varying team training loads (Enright et al., 2015; Morgans et al., 2014). Thus, the observed effects should be interpreted as the added contribution of a given training emphasis rather than as stand-alone prescriptions for team-based practice.

Practitioners may use the present findings to guide which training component receives greater emphasis within this broader training context. When short-distance acceleration, braking capacity, and aerial or force-dominant actions are prioritized, greater emphasis on Traditional Strength Training and, in some cases, Plyometric Jump Training may be warranted. When longer sprint exposure is a specific priority, speed-oriented methods may reasonably receive greater emphasis, although the current 30-40 m evidence remains uncertain. In many practical settings, a balanced multi-modal approach will remain the most appropriate strategy, with final decisions shaped by training age, competitive schedule, current readiness, and positional or tactical demands. Where match-relevant agility is a priority, improvements in planned COD ability should ideally be complemented by open-skill drills involving perceptual and decision-making demands, because gains in closed-skill directional change tests may not fully capture reactive agility performance in competition.

Limitations and future directions

Despite the comprehensive nature of this NMA, several limitations must be acknowledged. First, although we refined the intervention taxonomy using explicit operational criteria and a priori decision rules, some residual heterogeneity within nodes may remain. Second, while neither the local node-splitting analyses nor the global design-by-treatment interaction model identified statistically significant inconsistency, these findings should be interpreted as supportive rather than conclusive, particularly because several loops were sparse. Third, the included population was restricted mainly to male professional or academy-level players; therefore, generalizability to women's soccer and lower or different competitive levels remains uncertain. Fourth, the present network evaluated exercise modalities as stand-alone intervention categories and does not directly inform optimal sequencing or periodization within longer-term training plans. Fifth, outcome assessment was limited to immediate post-intervention effects, so the durability of adaptation could not be determined. Finally, for sprint outcomes, some residual measurement heterogeneity related to timing technology, start procedure, and test surface cannot be excluded, especially in the sparser 30 m and 40 m networks.

To strengthen the practical relevance of future evidence, randomized trials should move beyond isolated modality comparisons and more directly evaluate commonly used modality combinations and training sequences. At a minimum, future studies should report concurrent soccer load, adherence, injury or adverse-event data, and clearer outcome timing relative to the intervention and competitive schedule. Greater attention should also be given to women's soccer, developmental cohorts, and position-specific reporting. In addition, duration-stratified or adequately powered moderator analyses are needed to test whether shorter and longer programs differ meaningfully in their comparative effects.

Conclusion

This systematic review and network meta-analysis suggests that, among the pre-specified co-primary outcomes, Traditional Strength Training may provide the most consistent benefits for short-distance acceleration (5 - 20 m) and vertical jump performance in soccer players, although certainty varied across comparisons. Evidence for longer sprint distances (30 - 40 m) was more uncertain, and no intervention was statistically superior to Regular Training at 40 m. Secondary outcomes (COD and IRM) were interpreted as supportive rather than primary evidence, and the IRM finding should be viewed cautiously because of less stable sensitivity results and possible small-study effects. Overall, the present findings support cautious consideration of strength-oriented training within a broader multimodal conditioning approach when short-sprint acceleration and vertical jump performance are prioritized; however, the conclusions should be applied cautiously beyond predominantly male professional or academy-level samples and should not be taken as direct evidence for the optimal sequencing or periodization of strength, plyometric, and speed-oriented methods.

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The datasets generated during the current study are not publicly available but are available from the corresponding author upon reasonable request. The authors declare that they have no conflict of interest. This study was based exclusively on previously published literature and did not involve new data collection from human participants; therefore, ethical approval was not required. The authors declare that no Generative AI or AI-assisted technologies were used in the writing of this manuscript.

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Key points

- Traditional strength training provided the most consistent benefits for short-sprint acceleration (5-20 m) and vertical jump performance in soccer players.
- Speed training ranked highest for 30-m sprint performance, but its advantage over regular training was not statistically significant; no intervention showed a clear advantage for 40-m sprint performance.
- Secondary outcomes, including change-of-direction performance and 1RM strength, should be interpreted as supportive rather than primary evidence.

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Supplementary Table S1. Full Search Strategies for the Other Databases and Trial Registries

Database	Full search strategy
Embase	('exercise'/exp OR 'training'/exp OR 'strength training': ti,ab OR 'resistance training': ti,ab OR plyometric*: ti,ab OR sprint*: ti,ab OR speed:ti,ab OR endurance:ti,ab) AND ('soccer'/exp OR soccer:ti,ab OR 'association football': ti,ab OR 'soccer player*': ti,ab OR 'football player*': ti,ab)
Cochrane Library	([mh exercise] OR [mh "resistance training"] OR [mh sports] OR [mh soccer] OR exercise:ti,ab,kw OR training:ti,ab,kw OR "strength training":ti,ab,kw OR "resistance training":ti,ab,kw OR plyometric*:ti,ab,kw OR sprint*:ti,ab,kw OR speed:ti,ab,kw OR endurance:ti,ab,kw) AND ([mh soccer] OR soccer:ti,ab,kw OR "association football":ti,ab,kw OR "soccer player*":ti,ab,kw OR "football player*":ti,ab,kw)
Web of Science Core Collection	TS= ((exercise OR training OR "strength training" OR "resistance training" OR plyometric* OR sprint* OR speed OR endurance) AND (soccer OR "association football" OR "soccer player*" OR "football player*"))
SPORTDiscus	TX ((exercise OR training OR "strength training" OR "resistance training" OR plyometric* OR sprint* OR speed OR endurance) AND (soccer OR "association football" OR "soccer player*" OR "football player*"))
ClinicalTrials.gov	(soccer OR "association football" OR "soccer player" OR "football player") AND (exercise OR training OR "strength training" OR "resistance training" OR plyometric OR sprint OR speed OR endurance)
WHO ICTRP	(soccer OR "association football" OR "soccer player" OR "football player") AND (exercise OR training OR "strength training" OR "resistance training" OR plyometric OR sprint OR speed OR endurance)

No study-design filter was applied in some databases and trial registries to maximize search sensitivity; randomized controlled trials were subsequently identified during screening according to the predefined eligibility criteria.

Supplementary Table S2. Characteristics of the studies included in the meta-analysis.

Author	Country	Year	Age (mean \pm SD)	Sample size (test group / control group)	Intervention Details	Control	Outcome
Gao F.	China	2023	19.3 \pm 3.5	15/15	10 weeks Speed Training	Regular Training	30 m sprint
Little T.	UK	2006	24 \pm 3	18/18	3 times/week Flexibility Training	Regular Training	20 m sprint COD test
Sayers A.L.	USA	2008	19.35 \pm 0.99	20/20	1 week Flexibility Training	Regular Training	30 m sprint
Sánchez-Sánchez J.	Spain	2024	22.9 \pm 3.5	10/13	16 weeks Plyometric Jump Training	Regular Training	CMJ test COD test
Hostrup M.	Denmark	2019	22.8 \pm 2.2	12/10	10 weeks, 3 times/week Endurance Training	Speed Training	30 m sprint
Nobari H.	Iran	2023	23.1 \pm 2.8	10/9	13 weeks Speed Training	Plyometric Jump Training	20 m sprint, 30 m sprint COD test
Wallenta C.	Germany	2016	18.3 \pm 2.0	6/6	6 weeks, 2 times/week Speed Training	Traditional Strength Training	CMJ test 5 m sprint
Rønnestad B.R.	Norway	2011	22 \pm 2	7/7	10 weeks, 2 times/week Traditional Strength Training	Regular Training	40 m sprint 1RM test
Rønnestad B.R.	Norway	2006	23 \pm 2	6/7	7 weeks, 2 times/week Traditional Strength Training	Regular Training	1RM test, SJ test, CMJ test 30 m sprint
Rey E.	Spain	2016	23.6 \pm 2.7	10/9	6 weeks, 2 times/week Traditional Strength Training	Speed Training	CMJ test 30 m sprint

Supplementary Table S2. Continue...

Author	Country	Year	Age (mean \pm SD)	Sample size (test group / control group)	Intervention Details	Control	Outcome
López-Segovia M.	Spain	2010	18.43 \pm 0.6	19/18	16 weeks, 4 times/week Traditional Strength Training	Regular Training	CMJ test, 20 m sprint 30 m sprint
Moran J.	UK	2024	22.3 \pm 2.7	8/8	8 weeks, 2 times/week Speed Training	Regular Training	CMJ test COD test
Gee T.I.	UK	2021	17.1 \pm 0.6	9/8	10 weeks, 2 times/week Traditional Strength Training	Speed Training	40 m sprint COD test
Pareja-Blanco F.	Spain	2017	23.8 \pm 3.5	8/8	5 weeks, 3 times/week Traditional Strength Training	Regular Training	1RM test, CMJ test 30 m sprint
Loturco I.	Brazil	2015	23.4 \pm 3.6	12/11	4 weeks, 2 times/week Speed Training	Plyometric Jump Training	SJ test, 5 m sprint 20 m sprint
Loturco I.	Brazil	2017	21.7 \pm 2.4	11/11	5 weeks, 2 times/week Speed Training	Plyometric Jump Training	5 m sprint, 20 m sprint 30 m sprint, COD test SJ test, CMJ test
Iaia F.M.	Italy	2015	18.5 \pm 1	6/7	3 weeks, 3 times/week Speed Training	Endurance Training	20 m sprint 40 m sprint
Enright K.	UK	2015	17 \pm 2	8/7	5 weeks, 2 times/week Traditional Strength Training	Endurance Training	1RM test, SJ test CMJ test
Kobal R.	Brazil	2017	18.9 \pm 0.6	9/9	8 weeks, 2 times/week Traditional Strength Training	Speed Training	CMJ test, 20 m sprint COD test
Soares-Caldeira L.F.	Brazil	2014	22.6 \pm 6.7	6/7	4 weeks, 2 times/week Speed Training	Regular Training	SJ test CMJ test
Keiner M.	Germany	2022	17.45 \pm 0.52	11/11	40 weeks, 2 times/week Traditional Strength Training	Speed Training	1RM test, 20 m sprint COD test
Milanović Z.	Serbia	2014	18.5 \pm 0.4	66/66	12 weeks, 4 times/week Speed Training	Regular Training	20 m sprint
Chelly M.S.	Tunisia	2010	19.1 \pm 0.7	12/11	8 weeks, 2 times/week Speed Training	Regular Training	SJ test CMJ test
Bettariga F.	Italy	2022	25.4 \pm 4.9	12/12	6 weeks, 2 times/week Plyometric Jump Training	Regular Training	5 m sprint, 20 m sprint 30 m sprint
Silva-Neto M.E.	Brazil	2023	19 \pm 0.8	12/12	2 weeks Flexibility Training	Traditional Strength Training	CMJ test 30 m sprint
Dupont G.	France	2004	20.2 \pm 0.7	22/22	10 weeks Speed Training	Regular Training	40 m sprint
McMorrow B.J.	Ireland	2019	24.0 \pm 3.6	7/6	6 weeks, 1–2 times/week Speed Training	Traditional Strength Training	5 m sprint, 20 m sprint COD test
Hammami M.	Tunisia	2020	16.4 \pm 0.2	14/12	10 weeks, 2 times/week Plyometric Jump Training	Regular Training	5 m sprint, 20 m sprint 30 m sprint, 40 m sprint COD test, SJ test, CMJ test
Hammami M.	Tunisia	2018	16.1 \pm 0.5	14/12	8 weeks, 2 times/week Traditional Strength Training	Regular Training	SJ test, CMJ test, COD test, 1RM test 5 m sprint, 40 m sprint
Hammami M.	Tunisia	2018	16.8 \pm 0.2	16/12	8 weeks, 2 times/week Traditional Strength Training	Regular Training	COD test, SJ test, CMJ test, 1RM test 5 m sprint, 20 m sprint 30 m sprint, 40 m sprint
Hammami M.	Tunisia	2017	16.2 \pm 0.6	19/12	8 weeks, 2 times/week Traditional Strength Training	Regular Training	COD test, SJ test, CMJ test, 1RM test 5 m sprint, 20 m sprint 30 m sprint, 40 m sprint

Participants in all studies were soccer players. Data are presented as mean \pm standard deviation (SD). Intervention Details specify the duration and weekly frequency of the training programs. Intervention and Control groups are categorized according to the specific nodes used in the network meta-analysis: Traditional Strength Training (high-load resistance), Plyometric Jump Training (ballistic/jump exercises), Speed Training, Endurance Training, Flexibility Training, and Regular Training. Outcomes include linear sprint times (5 - 40 m), vertical jump height (SJ = Squat Jump; CMJ = Countermovement Jump), maximal strength (1RM = One-Repetition Maximum), and change of direction ability (COD).

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Bettariga F. 2022	+	?	-	+	+	?	?
Chelly M.S. 2010	?	?	?	+	+	+	+
Dupont G. 2004	+	-	?	+	?	+	?
Enright K. 2015	+	?	?	+	?	+	+
Gao F. 2023	+	?	-	?	+	+	?
Gee T.I. 2021	+	?	?	+	+	+	+
Hammami M. 2017	+	-	?	+	+	?	+
Hammami M. 2017	?	?	-	+	+	+	+
Hammami M. 2018	?	?	?	+	+	?	+
Hammami M. 2020	+	?	-	+	+	?	+
Hostrup M. 2019	+	?	-	+	+	?	+
Iaia F.M. 2015	?	?	?	+	+	+	+
Keiner M. 2022	+	?	?	+	+	+	?
Kobal R. 2017	+	-	?	?	+	+	+
Little T. 2006	+	?	-	?	+	?	+
López-Segovia M. 2010	+	?	-	?	+	+	+
Loturco I. 2015	+	?	-	?	+	+	+
Loturco I. 2017	+	?	?	?	?	+	+
McMorrow B.J. 2019	+	?	?	+	+	+	+
Milanović Z. 2014	+	-	?	+	+	?	+
Moran J. 2024	+	?	?	+	+	+	?
Nobari H. 2023	?	-	?	+	+	+	+
Pareja-Blanco F. 2017	+	?	-	+	?	?	+
Rey E. 2016	+	?	-	+	+	+	+
Rønnestad B.R. 2006	+	?	?	+	?	+	+
Rønnestad B.R. 2011	+	?	?	+	+	+	+
Sánchez-Sánchez J. 2024	+	-	?	?	+	+	?
Sayers A.L. 2008	+	-	?	+	+	+	?
Silva-Neto M.E. 2023	+	?	?	+	+	+	+
Soares-Caldeira L.F. 2014	+	?	-	+	+	?	+
Wallenta C. 2016	+	?	?	+	+	+	?

Supplementary Figure S1. Risk of bias for each included studies.

Supplementary Table S3. Consistency test for the 5 m sprint.

Comparison	Direct Effect (SE)	Indirect Effect (SE)	Inconsistency Factor (SE)	P-value
A vs. C	-0.029 (0.013)	-0.030 (29.506)	0.001 (29.506)	1.000
B vs. C	-0.060 (0.003)	-0.047 (0.020)	-0.013 (0.020)	0.509
B vs. D	-0.080 (0.013)	-0.093 (0.015)	0.013 (0.020)	0.509
C vs. D	-0.033 (0.015)	-0.020 (0.014)	-0.013 (0.020)	0.509

Data are presented as coefficient (standard error). Abbreviations: SE, standard error; A, Plyometric Jump Training; B, Regular Training; C, Speed Training; D, Traditional Strength Training. The P-value reflects the statistical evidence for a difference between direct and indirect estimates. A P-value > 0.05 indicates that no statistically significant inconsistency was detected; however, this does not establish consistency, particularly in sparse loops where power may be limited.

Supplementary Table S4. Consistency test for the 20 m sprint.

Comparison	Direct Effect (SE)	Indirect Effect (SE)	Inconsistency Factor (SE)	P-value
A vs. E	-0.040 (0.078)	-0.052 (96.095)	0.012 (96.095)	1.000
B vs. D	0.040 (0.064)	0.083 (513.315)	-0.043 (513.315)	1.000
C vs. D	0.055 (0.048)	0.033 (0.054)	0.022 (0.072)	0.759
C vs. E	-0.069 (0.041)	-0.047 (0.059)	-0.022 (0.072)	0.759
D vs. E	-0.090 (0.038)	-0.131 (0.046)	0.040 (0.060)	0.500
D vs. F	-0.160 (0.065)	-0.120 (0.045)	-0.040 (0.079)	0.611
E vs. F	-0.020 (0.030)	-0.061 (0.073)	0.040 (0.079)	0.611

Data are presented as coefficient (standard error). Abbreviations: SE, standard error; A, Endurance Training; B, Flexibility Training; C, Plyometric Jump Training; D, Regular Training; E, Speed Training; F, Traditional Strength Training. The P-value reflects the statistical evidence for a difference between direct and indirect estimates. A P-value > 0.05 indicates that no statistically significant inconsistency was detected; however, this does not establish consistency, particularly in sparse loops where power may be limited.

Supplementary Table S5. Consistency test for the 30 m sprint.

Comparison	Direct Effect (SE)	Indirect Effect (SE)	Inconsistency Factor (SE)	P-value
A vs. E	-0.020 (0.127)	-0.113 (93.216)	0.093 (93.216)	0.999
B vs. D	-0.100 (0.153)	0.021 (0.163)	-0.121 (0.223)	0.587
B vs. F	-0.120 (0.149)	-0.241 (0.166)	0.121 (0.223)	0.587
C vs. D	0.123 (0.106)	0.177 (0.154)	-0.054 (0.187)	0.771
C vs. E	-0.010 (0.093)	-0.064 (0.162)	0.054 (0.187)	0.771
D vs. E	-0.230 (0.195)	-0.145 (0.102)	-0.085 (0.220)	0.699
D vs. F	-0.142 (0.071)	-0.088 (0.139)	-0.054 (0.156)	0.727
E vs. F	0.030 (0.143)	0.036 (0.135)	-0.006 (0.197)	0.975

Data are presented as coefficient (standard error). Abbreviations: SE, standard error; A, Endurance Training; B, Flexibility Training; C, Plyometric Jump Training; D, Regular Training; E, Speed Training; F, Traditional Strength Training. The P-value reflects the statistical evidence for a difference between direct and indirect estimates. A P-value > 0.05 indicates that no statistically significant inconsistency was detected; however, this does not establish consistency, particularly in sparse loops where power may be limited.

Supplementary Table S6. Consistency test for the 40 m sprint.

Comparison	Direct Effect (SE)	Indirect Effect (SE)	Inconsistency Factor (SE)	P-value
A vs. B	0.200 (0.153)	0.245 (0.268)	-0.045 (0.309)	0.883
A vs. C	0.020 (0.173)	-0.025 (0.256)	0.045 (0.309)	0.883
B vs. D	-0.135 (0.074)	-0.090 (0.300)	-0.045 (0.309)	0.883
C vs. D	0.090 (0.191)	0.045 (0.243)	0.045 (0.309)	0.883

Data are presented as coefficient (standard error). Abbreviations: SE, standard error; A, Endurance Training; B, Regular Training; C, Speed Training; D, Traditional Strength Training. The P-value reflects the statistical evidence for a difference between direct and indirect estimates. A P-value > 0.05 indicates that no statistically significant inconsistency was detected; however, this does not establish consistency, particularly in sparse loops where power may be limited.

Supplementary Table S7. Consistency test for the SJ test.

Comparison	Direct Effect (SE)	Indirect Effect (SE)	Inconsistency Factor (SE)	P-value
A vs. B	-2.000 (3.008)	-3.755 (2.747)	1.755 (4.074)	0.667
A vs. C	-0.503 (2.379)	1.256 (3.307)	-1.759 (4.073)	0.666
B vs. C	2.823 (1.696)	3.384 (2.042)	-0.560 (2.652)	0.833
B vs. D	4.795 (1.443)	3.292 (2.417)	1.503 (2.815)	0.593
C vs. D	0.676 (1.876)	2.180 (2.102)	-1.504 (2.815)	0.593

Data are presented as coefficient (standard error). Abbreviations: SE, standard error; A, Plyometric Jump Training; B, Regular Training; C, Speed Training; D, Traditional Strength Training. The P-value reflects the statistical evidence for a difference between direct and indirect estimates. A P-value > 0.05 indicates that no statistically significant inconsistency was detected; however, this does not establish consistency, particularly in sparse loops where power may be limited.

Supplementary Table S8. Consistency test for the CMJ test.

Comparison	Direct Effect (SE)	Indirect Effect (SE)	Inconsistency Factor (SE)	P-value
A vs. D	-1.680 (2.470)	-4.227 (1.866)	2.547 (3.095)	0.411
A vs. F	-0.460 (1.674)	2.088 (2.610)	-2.548 (3.094)	0.410
B vs. C	0.707 (1.483)	0.211 (1.181)	0.496 (1.896)	0.793
B vs. D	-3.872 (1.281)	-2.462 (1.021)	-1.410 (1.638)	0.390
B vs. E	0.219 (1.201)	-0.598 (1.213)	0.817 (1.707)	0.632
B vs. F	0.722 (1.275)	0.477 (1.218)	0.245 (1.752)	0.889
C vs. D	-3.538 (1.201)	-3.270 (1.333)	-0.269 (1.797)	0.881
C vs. E	-0.178 (1.365)	-0.962 (1.304)	0.783 (1.887)	0.678
D vs. E	0.341 (1.770)	3.712 (1.049)	-3.372 (2.077)	0.105
D vs. F	4.174 (1.121)	2.876 (1.239)	1.297 (1.670)	0.437
E vs. F	-0.149 (1.774)	1.212 (1.219)	-1.361 (2.164)	0.529

Data are presented as coefficient (standard error). Abbreviations: SE, standard error; A, Endurance Training; B, Flexibility Training; C, Plyometric Jump Training; D, Regular Training; E, Speed Training; F, Traditional Strength Training. The P-value reflects the statistical evidence for a difference between direct and indirect estimates. A P-value > 0.05 indicates that no statistically significant inconsistency was detected; however, this does not establish consistency, particularly in sparse loops where power may be limited.

Supplementary Table S9. Consistency test for the COD test.

Comparison	Direct Effect (SE)	Indirect Effect (SE)	Inconsistency Factor (SE)	P-value
A vs. C	-0.040 (0.042)	-0.053 (0.046)	0.013 (0.062)	0.832
A vs. D	0.060 (0.036)	0.073 (0.051)	-0.013 (0.062)	0.832
B vs. C	-0.100 (0.079)	-0.144 (0.046)	0.044 (0.091)	0.629
B vs. D	-0.030 (0.038)	0.014 (0.083)	-0.044 (0.091)	0.629
C vs. D	0.079 (0.040)	0.132 (0.033)	-0.053 (0.052)	0.304
C vs. E	0.185 (0.044)	0.095 (0.035)	0.089 (0.056)	0.110
D vs. E	0.011 (0.017)	0.100 (0.053)	-0.089 (0.056)	0.110

Data are presented as coefficient (standard error). Abbreviations: SE, standard error; A, Flexibility Training; B, Plyometric Jump Training; C, Regular Training; D, Speed Training; E, Traditional Strength Training. The P-value reflects the statistical evidence for a difference between direct and indirect estimates. A P-value > 0.05 indicates that no statistically significant inconsistency was detected; however, this does not establish consistency, particularly in sparse loops where power may be limited.

Supplementary Table S10. Consistency test for the 1RM test.

Comparison	Direct Effect (SE)	Indirect Effect (SE)	Inconsistency Factor (SE)	P-value
A vs. B	3.731 (10.873)	1.005 (10.602)	2.726 (15.175)	0.857
A vs. C	0.000 (16.066)	11.906 (11.001)	-11.906 (19.472)	0.541
A vs. D	25.426 (11.033)	21.103 (10.517)	4.323 (15.217)	0.776
B vs. C	14.478 (10.973)	-1.998 (10.323)	16.476 (15.067)	0.274
B vs. D	18.822 (6.013)	27.615 (11.021)	-8.793 (12.554)	0.484
C vs. D	19.798 (11.355)	10.916 (10.713)	8.883 (15.610)	0.569

Data are presented as coefficient (standard error). Abbreviations: SE, standard error; A, Flexibility Training; B, Regular Training; C, Speed Training; D, Traditional Strength Training. The P-value reflects the statistical evidence for a difference between direct and indirect estimates. A P-value > 0.05 indicates that no statistically significant inconsistency was detected; however, this does not establish consistency, particularly in sparse loops where power may be limited.

Supplementary Table S11. League table on the 5 m sprint.

Traditional Strength	0.03 (0.01, 0.05)	0.06 (0.02, 0.09)	0.09 (0.07, 0.11)
-0.03 (-0.05, -0.01)	Speed Training	0.03 (0.00, 0.05)	0.06 (0.05, 0.07)
-0.06 (-0.09, -0.02)	-0.03 (-0.05, 0.00)	Plyometric Jump	0.03 (0.00, 0.06)
-0.09 (-0.11, -0.07)	-0.06 (-0.07, -0.05)	-0.03 (-0.06, -0.00)	Regular Training

Data are expressed as mean differences (95% confidence intervals). Bolded estimates indicate statistically significant differences, where the 95% confidence interval does not overlap zero. Comparisons should be read from left to right: the estimate at the intersection of a column and a row represents the comparative effect between those treatments. Abbreviations: Speed Training, Speed Training; Plyometric Jump, Plyometric Jump Training; Traditional Strength, Traditional Strength Training; Endurance Training, Endurance Training; Regular Training, Regular Training; Flexibility Training, Flexibility Training.

Supplementary Table S12. League table on the 20 m sprint.

Traditional Strength	0.03 (-0.03, 0.08)	0.07 (-0.09, 0.23)	0.09 (-0.05, 0.24)	0.09 (0.01, 0.17)	0.13 (0.06, 0.20)
-0.03 (-0.08, 0.03)	Speed Training	0.04 (-0.11, 0.19)	0.07 (-0.07, 0.20)	0.06 (-0.00, 0.12)	0.11 (0.05, 0.16)
-0.07 (-0.23, 0.09)	-0.04 (-0.19, 0.11)	Endurance Training	0.03 (-0.18, 0.23)	0.02 (-0.14, 0.19)	0.07 (-0.10, 0.23)
-0.09 (-0.24, 0.05)	-0.07 (-0.20, 0.07)	-0.03 (-0.23, 0.18)	Flexibility Training	-0.00 (-0.15, 0.14)	0.04 (-0.08, 0.16)
-0.09 (-0.17, -0.01)	-0.06 (-0.12, 0.00)	-0.02 (-0.19, 0.14)	0.00 (-0.14, 0.15)	Plyometric Jump	0.04 (-0.02, 0.11)
-0.13 (-0.20, -0.06)	-0.11 (-0.16, -0.05)	-0.07 (-0.23, 0.10)	-0.04 (-0.16, 0.08)	-0.04 (-0.11, 0.02)	Regular Training

Data are expressed as mean differences (95% confidence intervals). Bolded estimates indicate statistically significant differences, where the 95% confidence interval does not overlap zero. Comparisons should be read from left to right: the estimate at the intersection of a column and a row represents the comparative effect between those treatments. Abbreviations: Speed Training, Speed Training; Plyometric Jump, Plyometric Jump Training; Traditional Strength, Traditional Strength Training; Endurance Training, Endurance Training; Regular Training, Regular Training; Flexibility Training, Flexibility Training.

Supplementary Table S13. League table on the 30 m sprint.

Speed Training	0.02 (-0.12, 0.17)	0.03 (-0.15, 0.21)	0.02 (-0.23, 0.27)	0.16 (-0.01, 0.34)	0.21 (-0.06, 0.47)
-0.02 (-0.17, 0.12)	Plyometric Jump	0.01 (-0.18, 0.19)	-0.00 (-0.29, 0.29)	0.14 (-0.02, 0.30)	0.18 (-0.08, 0.44)
-0.03 (-0.21, 0.15)	-0.01 (-0.19, 0.18)	Traditional Strength	-0.01 (-0.32, 0.30)	0.13 (0.01, 0.25)	0.17 (-0.04, 0.38)
-0.02 (-0.27, 0.23)	0.00 (-0.29, 0.29)	0.01 (-0.30, 0.32)	Endurance Training	0.14 (-0.16, 0.45)	0.19 (-0.18, 0.55)
-0.16 (-0.34, 0.01)	-0.14 (-0.30, 0.02)	-0.13 (-0.25, -0.01)	-0.14 (-0.45, 0.16)	Regular Training	0.04 (-0.17, 0.25)
-0.21 (-0.47, 0.06)	-0.18 (-0.44, 0.08)	-0.17 (-0.38, 0.04)	-0.19 (-0.55, 0.18)	-0.04 (-0.25, 0.17)	Flexibility Training

Data are expressed as mean differences (95% confidence intervals). Bolded estimates indicate statistically significant differences, where the 95% confidence interval does not overlap zero. Comparisons should be read from left to right: the estimate at the intersection of a column and a row represents the comparative effect between those treatments. Abbreviations: Speed Training, Speed Training; Plyometric Jump, Plyometric Jump Training; Traditional Strength, Traditional Strength Training; Endurance Training, Endurance Training; Regular Training, Regular Training; Flexibility Training, Flexibility Training.

Supplementary Table S14. League table on the 40 m sprint.

Endurance Training	0.01 (-0.25, 0.27)	0.08 (-0.17, 0.33)	0.21 (-0.03, 0.45)
-0.01 (-0.27, 0.25)	Speed Training	0.07 (-0.20, 0.35)	0.20 (-0.08, 0.48)
-0.08 (-0.33, 0.17)	-0.07 (-0.35, 0.20)	Traditional Strength	0.13 (-0.00, 0.26)
-0.21 (-0.45, 0.03)	-0.20 (-0.48, 0.08)	-0.13 (-0.26, 0.00)	Regular Training

Data are expressed as mean differences (95% confidence intervals). Bolded estimates indicate statistically significant differences, where the 95% confidence interval does not overlap zero. Comparisons should be read from left to right: the estimate at the intersection of a column and a row represents the comparative effect between those treatments. Abbreviations: Speed Training, Speed Training; Plyometric Jump, Plyometric Jump Training; Traditional Strength, Traditional Strength Training; Endurance Training, Endurance Training; Regular Training, Regular Training; Flexibility Training, Flexibility Training.

Supplementary Table S15. League table on the SJ test.

Traditional Strength	-1.33 (-3.97, 1.32)	-1.44 (-5.58, 2.70)	-4.40 (-6.74, -2.07)
1.33 (-1.32, 3.97)	Speed Training	-0.12 (-3.73, 3.50)	-3.07 (-5.50, -0.65)
1.44 (-2.70, 5.58)	0.12 (-3.50, 3.73)	Plyometric Jump	-2.96 (-6.75, 0.83)
4.40 (2.07, 6.74)	3.07 (0.65, 5.50)	2.96 (-0.83, 6.75)	Regular Training

Data are expressed as mean differences (95% confidence intervals). Bolded estimates indicate statistically significant differences, where the 95% confidence interval does not overlap zero. Comparisons should be read from left to right: the estimate at the intersection of a column and a row represents the comparative effect between those treatments. Abbreviations: Speed Training, Speed Training; Plyometric Jump, Plyometric Jump Training; Traditional Strength, Traditional Strength Training; Endurance Training, Endurance Training; Regular Training, Regular Training; Flexibility Training, Flexibility Training.

Supplementary Table S16. League table on the CMJ test.

Traditional Strength	-0.17 (-2.19, 1.85)	-0.27 (-3.02, 2.47)	-0.57 (-2.25, 1.11)	-0.75 (-2.63, 1.14)	-3.58 (-5.15, -2.00)
0.17 (-1.85, 2.19)	Plyometric Jump	-0.11 (-3.32, 3.11)	-0.40 (-2.15, 1.36)	-0.58 (-2.37, 1.21)	-3.41 (-5.09, -1.72)
0.27 (-2.47, 3.02)	0.11 (-3.11, 3.32)	Endurance Training	-0.29 (-3.35, 2.77)	-0.47 (-3.63, 2.69)	-3.30 (-6.19, -0.41)
0.57 (-1.11, 2.25)	0.40 (-1.36, 2.15)	0.29 (-2.77, 3.35)	Flexibility Training	-0.18 (-1.80, 1.44)	-3.01 (-4.57, -1.45)
0.75 (-1.14, 2.63)	0.58 (-1.21, 2.37)	0.47 (-2.69, 3.63)	0.18 (-1.44, 1.80)	Speed Training	-2.83 (-4.55, -1.10)
3.58 (2.00, 5.15)	3.41 (1.72, 5.09)	3.30 (0.41, 6.19)	3.01 (1.45, 4.57)	2.83 (1.10, 4.55)	Regular Training

Data are expressed as mean differences (95% confidence intervals). Bolded estimates indicate statistically significant differences, where the 95% confidence interval does not overlap zero. Comparisons should be read from left to right: the estimate at the intersection of a column and a row represents the comparative effect between those treatments. Abbreviations: Speed Training, Speed Training; Plyometric Jump, Plyometric Jump Training; Traditional Strength, Traditional Strength Training; Endurance Training, Endurance Training; Regular Training, Regular Training; Flexibility Training, Flexibility Training.

Supplementary Table S17. League table on the COD test.

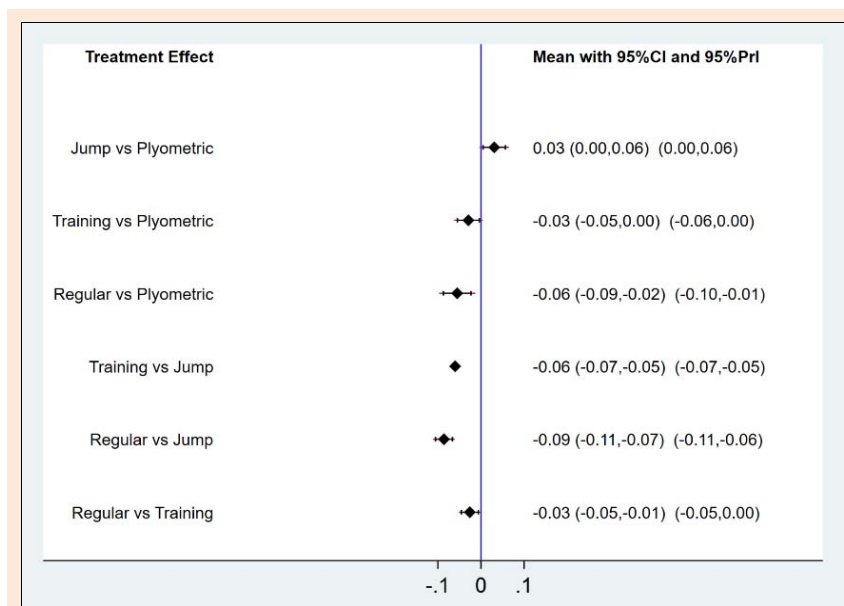
Traditional Strength	0.00 (-0.07, 0.08)	-0.02 (-0.05, 0.01)	-0.08 (-0.15, -0.02)	-0.13 (-0.18, -0.08)
-0.00 (-0.08, 0.07)	Plyometric Jump	-0.02 (-0.09, 0.04)	-0.09 (-0.17, -0.00)	-0.13 (-0.21, -0.05)
0.02 (-0.01, 0.05)	0.02 (-0.04, 0.09)	Speed Training	-0.06 (-0.12, -0.01)	-0.11 (-0.16, -0.06)
0.08 (0.02, 0.15)	0.09 (0.00, 0.17)	0.06 (0.01, 0.12)	Flexibility Training	-0.05 (-0.11, 0.01)
0.13 (0.08, 0.18)	0.13 (0.05, 0.21)	0.11 (0.06, 0.16)	0.05 (-0.01, 0.11)	Regular Training

Data are expressed as mean differences (95% confidence intervals). Bolded estimates indicate statistically significant differences, where the 95% confidence interval does not overlap zero. Comparisons should be read from left to right: the estimate at the intersection of a column and a row represents the comparative effect between those treatments. Abbreviations: Speed Training, Speed Training; Plyometric Jump, Plyometric Jump Training; Traditional Strength, Traditional Strength Training; Endurance Training, Endurance Training; Regular Training, Regular Training; Flexibility Training, Flexibility Training.

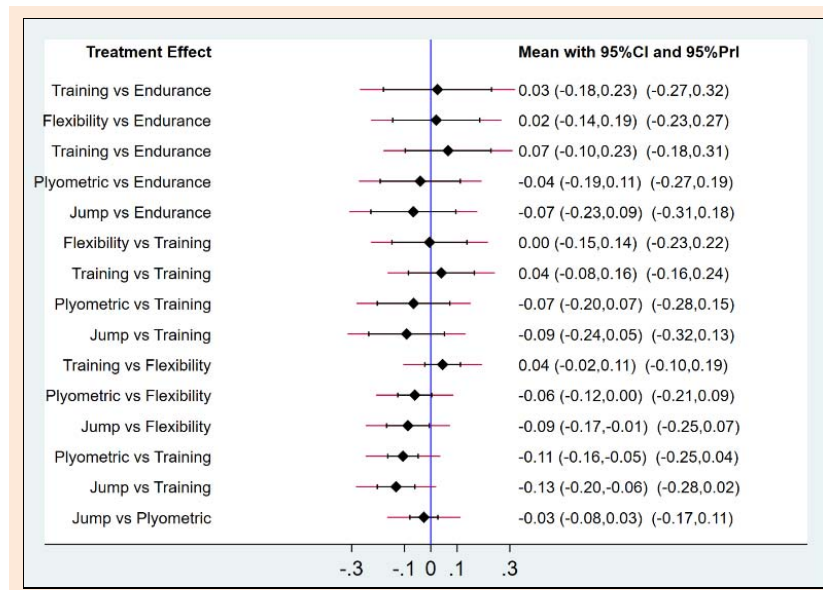
Supplementary Table S18. League table on the 1RM test.

Traditional Strength	-15.12 (-30.02, -0.22)	-20.86 (-30.98, -10.73)	-23.28 (-37.68, -8.89)
15.12 (0.22, 30.02)	Speed Training	-5.74 (-20.63, 9.15)	-8.16 (-25.63, 9.30)
20.86 (10.73, 30.98)	5.74 (-9.15, 20.63)	Regular Training	-2.42 (-16.74, 11.89)
23.28 (8.89, 37.68)	8.16 (-9.30, 25.63)	2.42 (-11.89, 16.74)	Flexibility Training

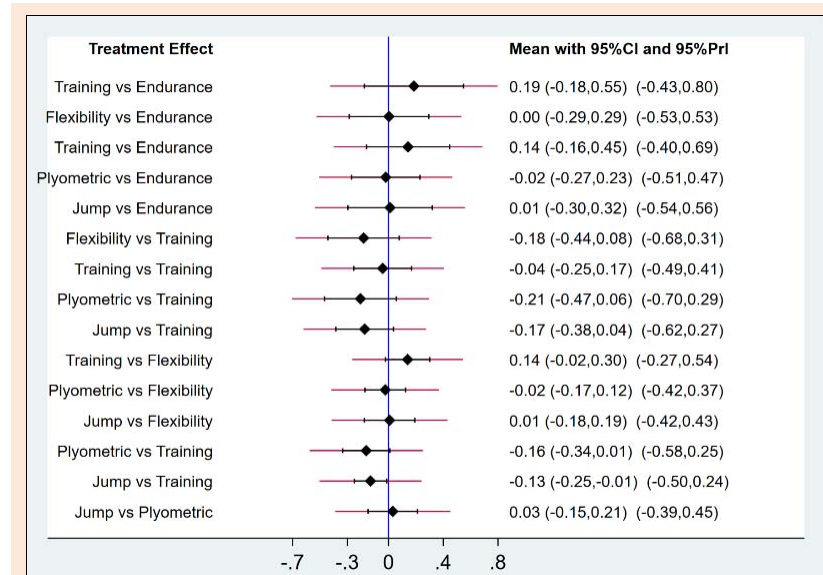
Data are expressed as mean differences (95% confidence intervals). Bolded estimates indicate statistically significant differences, where the 95% confidence interval does not overlap zero. Comparisons should be read from left to right: the estimate at the intersection of a column and a row represents the comparative effect between those treatments. Abbreviations: Speed Training, Speed Training; Plyometric Jump, Plyometric Jump Training; Traditional Strength, Traditional Strength Training; Endurance Training, Endurance Training; Regular Training, Regular Training; Flexibility Training, Flexibility Training.



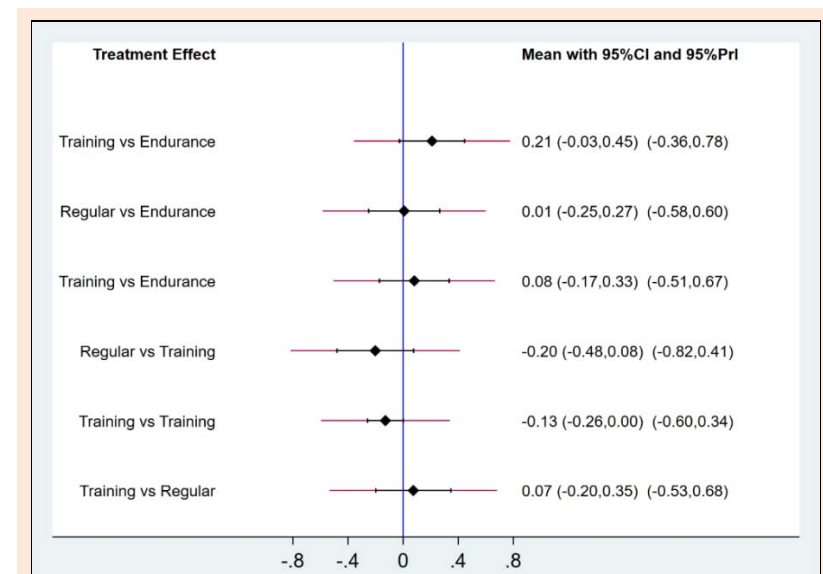
Supplementary Figure S2. Forest plot of the network meta-analysis for 5 m sprint performance.



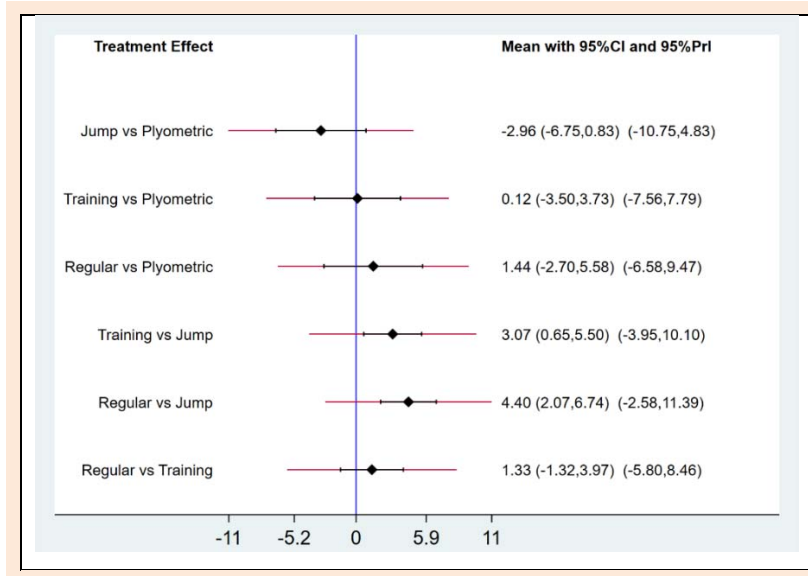
Supplementary Figure S3. Forest plot of the network meta-analysis for 20 m sprint performance.



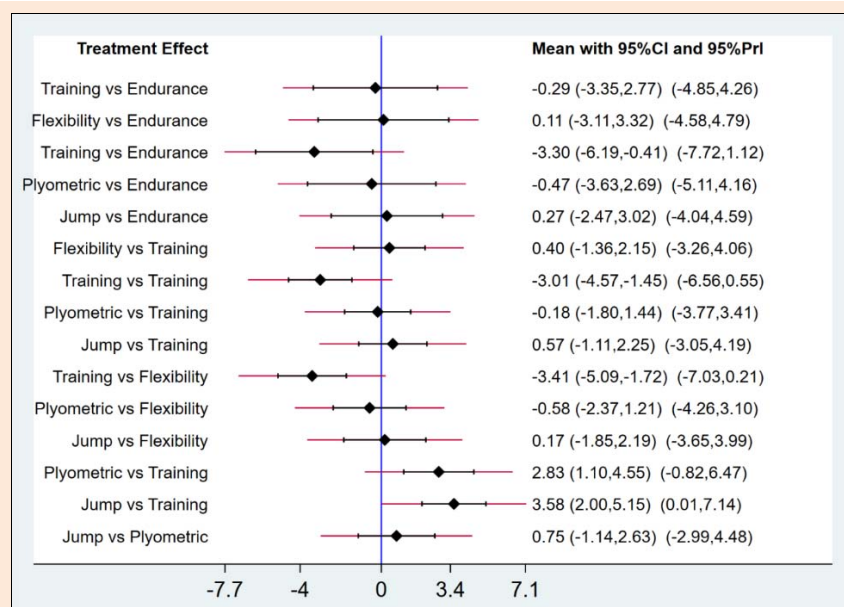
Supplementary Figure S4. Forest plot of the network meta-analysis for 30 m sprint performance.



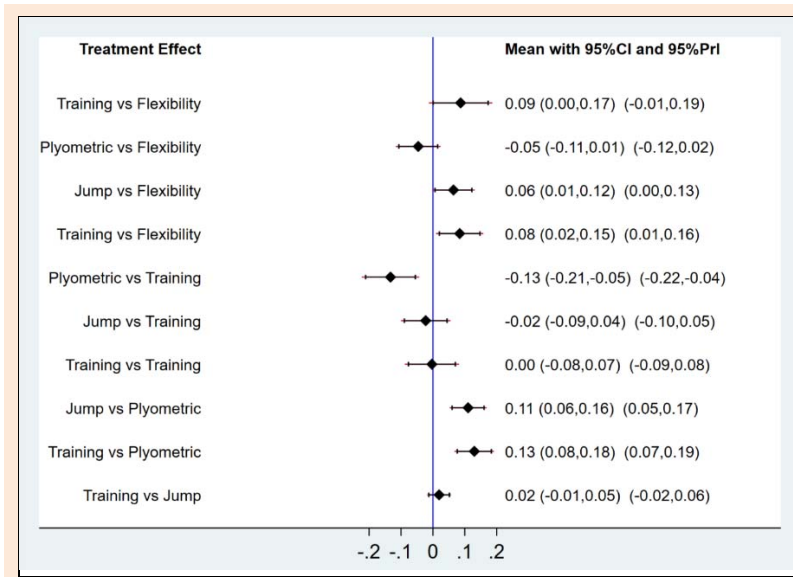
Supplementary Figure S5. Forest plot of the network meta-analysis for 40 m sprint performance.



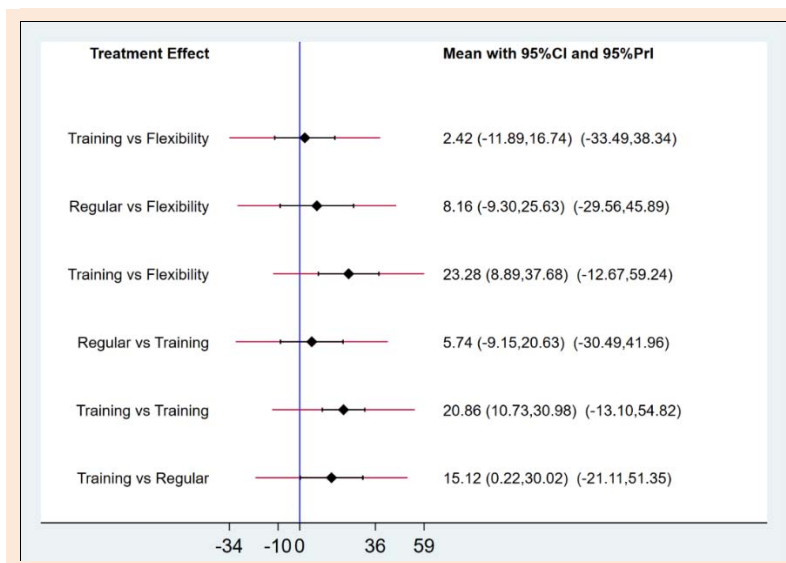
Supplementary Figure S6. Forest plot of the network meta-analysis for SJ performance.



Supplementary Figure S7. Forest plot of the network meta-analysis for CMJ performance.



Supplementary Figure S8. Forest plot of the network meta-analysis for COD performance.



Supplementary Figure S9. Forest plot of the network meta-analysis for 1RM performance.

Supplementary Table S19. Assessment of Publication Bias via Begg’s Rank Correlation and Egger’s Linear Regression Tests.

Outcome Measure	No. of Studies (n)	Begg's Z-score	Begg's P-value	Egger's Bias Coeff.	Egger's P-value	Interpretation
5 m Sprint	10	1.16	0.245	0.759	0.195	No Bias
20 m Sprint	13	0.37	0.714	-0.332	0.669	No Bias
30 m Sprint	13	-0.73	0.464	-0.869	0.422	No Bias
40 m Sprint	8	0.00	1.000	-1.756	0.417	Not formally assessed due to <10 studies
SJ	15	-0.35	0.729	5.204	0.893	No Bias
CMJ	28	-0.43	0.664	-0.032	0.978	No Bias
COD	17	0.99	0.323	1.399	0.167	No Bias
1RM	16	-0.72	0.471	-3.990	0.009	Significant Bias

SJ: Squat Jump; CMJ: Countermovement Jump; COD: Change of Direction; 1RM: One-Repetition Maximum. Begg’s Test: Measures the rank correlation between the effect sizes and their variances. Z-scores and P-values are reported without continuity correction. Egger’s Test: A linear regression of the precision of the studies against the standardized effect. The "Bias" coefficient represents the intercept; a significant P-value ($P < 0.05$) indicates potential asymmetry and publication bias. Significance: Bolded values denote statistical significance ($P < 0.05$), indicating evidence of publication bias in the 1RM subgroup.

Supplementary Table S20. CINeMA confidence evidence profile for the network meta-analysis of the 5 m sprint performance.

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating
Plyometric Jump Training:Speed Training	2	Some concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Very Low
Regular Training:Speed Training	3	No concerns	Some concerns	No concerns	No concerns	No concerns	No concerns	Low
Regular Training:Traditional Strength Training	1	Some concerns	Some concerns	No concerns	No concerns	No concerns	No concerns	Low
Speed Training:Traditional Strength Training	4	No concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Low
Plyometric Jump Training:Regular Training	0	Some concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Very Low
Plyometric Jump Training:Traditional Strength Training	0	Some concerns	Some concerns	No concerns	No concerns	No concerns	No concerns	Very Low

Supplementary Table S21. CINeMA confidence evidence profile for the network meta-analysis of the 20 m sprint performance.

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating
Endurance Training:Speed Training	1	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Flexibility Training:Regular Training	1	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Plyometric Jump Training:Regular Training	2	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Plyometric Jump Training:Speed Training	2	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Regular Training:Speed Training	2	No concerns	Some concerns	No concerns	No concerns	Major concern	No concerns	Very Low
Regular Training:Traditional Strength Training	1	No concerns	Some concerns	No concerns	No concerns	Major concern	No concerns	Very Low
Speed Training:Traditional Strength Training	4	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Endurance Training:Flexibility Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Endurance Training:Plyometric Jump Training	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Endurance Training:Regular Training	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Endurance Training:Traditional Strength Training	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Flexibility Training:Plyometric Jump Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Flexibility Training:Speed Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Flexibility Training:Traditional Strength Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Plyometric Jump Training:Traditional Strength Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low

Supplementary Table S22. CINeMA confidence evidence profile for the network meta-analysis of the 30 m sprint performance.

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating
Endurance Training:Speed Training	1	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Flexibility Training:Regular Training	1	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Flexibility Training:Traditional Strength Training	1	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Plyometric Jump Training:Regular Training	2	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Plyometric Jump Training:Speed Training	2	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Regular Training:Speed Training	1	Some concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Very Low
Regular Training:Traditional Strength Training	4	No concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Very Low
Speed Training:Traditional Strength Training	1	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Endurance Training:Flexibility Training	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Endurance Training:Plyometric Jump Training	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Endurance Training:Regular Training	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Endurance Training:Traditional Strength Training	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Flexibility Training:Plyometric Jump Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Flexibility Training:Speed Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Plyometric Jump Training: Traditional Strength Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low

Supplementary Table S23. CINeMA confidence evidence profile for the 40 m sprint performance.

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating
Endurance Training: Regular Training	1	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Endurance Training: Speed Training	1	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Regular Training: Traditional Strength Training	5	No concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Low
Speed Training: Traditional Strength Training	1	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Endurance Training: Traditional Strength Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Regular Training: Speed Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low

Supplementary Table S24. CINeMA confidence evidence profile for the Squat Jump (SJ) performance.

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating
Plyometric Jump Training: Regular Training	1	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Plyometric Jump Training: Speed Training	2	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Regular Training: Speed Training	4	No concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Low
Regular Training: Traditional Strength Training	5	No concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Low
Speed Training: Traditional Strength Training	3	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Plyometric Jump Training: Traditional Strength Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low

Supplementary Table S25. CINEMA confidence evidence profile for the Countermovement Jump (CMJ) performance.

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating
Endurance Training: Regular Training	1	No concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Low
Endurance Training: Traditional Strength Training	2	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Flexibility Training: Plyometric Jump Training	2	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Flexibility Training: Regular Training	3	No concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Low
Flexibility Training: Speed Training	3	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Flexibility Training: Traditional Strength Training	3	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Plyometric Jump Training: Regular Training	3	Some concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Very Low
Plyometric Jump Training: Speed Training	3	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Regular Training: Speed Training	2	No concerns	Some concerns	No concerns	No concerns	Major concerns	Major concerns	Low
Regular Training: Traditional Strength Training	4	No concerns	Some concerns	No concerns	No concerns	No concerns	No concerns	Low
Speed Training: Traditional Strength Training	2	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Endurance Training: Flexibility Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Endurance Training: Plyometric Jump Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Endurance Training: Speed Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Plyometric Jump Training: Traditional Strength Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low

Supplementary Table S26. CINEMA confidence evidence profile for the Change of Direction (COD) performance.

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating
Flexibility Training:Regular Training	1	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Flexibility Training:Speed Training	1	Some concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Low
Plyometric Jump Training:Regular Training	1	No concerns	Some concerns	No concerns	No concerns	No concerns	No concerns	Very Low
Plyometric Jump Training:Speed Training	1	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Regular Training:Speed Training	2	No concerns	Some concerns	No concerns	No concerns	No concerns	No concerns	Low
Regular Training:Traditional Strength Training	3	No concerns	Some concerns	No concerns	No concerns	No concerns	No concerns	Low
Speed Training:Traditional Strength Training	8	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Flexibility Training:Plyometric Jump Training	0	Some concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Very Low
Flexibility Training:Traditional Strength Training	0	Some concerns	Some concerns	No concerns	No concerns	No concerns	No concerns	Low
Plyometric Jump Training:Traditional Strength Training	0	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low

Supplementary Table S27. CINEMA confidence evidence profile for the One-Repetition Maximum (1RM) strength.

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating
Flexibility Training:Regular Training	2	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low
Flexibility Training:Speed Training	1	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Flexibility Training:Traditional Strength Training	2	No concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Low
Regular Training:Speed Training	2	No concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Very Low
Regular Training:Traditional Strength Training	7	No concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Very Low
Speed Training:Traditional Strength Training	2	No concerns	Some concerns	No concerns	No concerns	Major concerns	No concerns	Very Low

Supplementary Table S28. Network Meta-Regression Analysis of Pre-Specified Effect Modifiers to Evaluate Transitivity Across Performance Outcomes.

Outcome	Variable	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
5 m Sprint	Age/Maturation	.0421	.0215	1.96	0.050	.0000, .0842
	Playing Standard	.0312	.0458	0.68	0.496	-.0585, .1209
	Season Phase	-.0104	.0321	-0.32	0.746	-.0733, .0525
	Baseline Ability	.1105	.0542	2.04	0.041	.0043, .2167
20 m Sprint	Age/Maturation	.0235	.0184	1.28	0.201	-.0126, .0596
	Playing Standard	.1311	.1308	1.00	0.316	-.1253, .3875
	Season Phase	.0452	.0512	0.88	0.379	-.0551, .1455
	Baseline Ability	.0984	.0423	2.33	0.020	.0155, .1813
30 m Sprint	Age/Maturation	.0156	.0245	0.64	0.524	-.0324, .0636
	Playing Standard	.0842	.0712	1.18	0.237	-.0553, .2237
	Season Phase	-.1204	.0654	-1.84	0.066	-.2486, .0078
	Baseline Ability	.2104	.0952	2.21	0.027	.0238, .3970
40 m Sprint	Age/Maturation	.0087	.0312	0.28	0.780	-.0524, .0698
	Playing Standard	.0543	.0821	0.66	0.509	-.1066, .2152
	Season Phase	.1842	.0912	2.02	0.043	.0054, .3630
	Baseline Ability	.2511	.1124	2.23	0.026	.0308, .4714
Squat Jump (SJ)	Age/Maturation	1.4210	.6532	2.18	0.029	.1407, 2.7013
	Playing Standard	.8542	.9214	0.93	0.352	-.9517, 2.6601
	Season Phase	-.4210	.5123	-0.82	0.412	-1.4251, .5831
	Baseline Ability	1.1024	.4521	2.44	0.015	.2163, 1.9885
Countermovement Jump (CMJ)	Age/Maturation	1.1245	.4852	2.32	0.020	.1735, 2.0755
	Playing Standard	.5210	.8124	0.64	0.522	-1.0713, 2.1133
	Season Phase	.2145	.3214	0.67	0.503	-.4154, .8444
	Baseline Ability	.9421	.4124	2.28	0.023	.1338, 1.7504
Change of Direction (COD)	Age/Maturation	.0312	.0254	1.23	0.219	-.0186, .0810
	Playing Standard	.0842	.0412	2.04	0.041	.0034, .1650
	Season Phase	.0102	.0214	0.48	0.631	-.0317, .0521
	Baseline Ability	.1204	.0512	2.35	0.019	.0200, .2208
Maximal Strength (1RM)	Age/Maturation	3.2145	1.8421	1.75	0.081	-.3960, 6.8250
	Playing Standard	5.2142	2.1052	2.48	0.013	1.0880, 9.3404
	Season Phase	1.1024	1.4521	0.76	0.447	-1.7437, 3.9485
	Baseline Ability	4.4210	1.9521	2.26	0.024	.5949, 8.2471

This table presents a comprehensive network meta-regression analysis to evaluate potential effect modifiers across eight performance outcomes. Variables including Age/Maturation, Playing Standard, Season Phase, and Baseline Ability were pre-specified to assess their impact on intervention efficacy and ensure the assumption of transitivity. Coefficients (Coef.) represent the change in Mean Difference (MD) per unit change in the modifier, with P-values in bold denoting statistical significance ($P < 0.05$). The significant influence of Baseline Ability across all outcomes and Age/Maturation in jump tests (SJ and CMJ) confirms their roles as key modifiers, while the lack of significant interaction for Playing Standard and Season Phase in sprint acceleration (5 m-20 m) indicates that the comparative hierarchical rankings remain stable across these participant characteristics. All participant-related modifiers were analyzed in separate univariable network meta-regression models. No multivariable models were fitted. Covariate data were complete for all included studies; therefore, no imputation was required and no studies were excluded because of missing covariate information. Findings should be interpreted cautiously because some outcome networks were sparse.

Supplementary Table S29. Network Meta-Regression Analysis of Training Dosage Modifiers Across Eight Performance Outcomes.

Outcome	Variable	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
5 m Sprint	Sessions/week	-0.0044	0.0038	-1.17	0.242	-0.0118, 0.0030
	Minutes/session	0.0001	0.0005	0.20	0.841	-0.0009, 0.0011
	Intensity	0.0029	0.0097	0.30	0.761	-0.0161, 0.0220
20 m Sprint	Sessions/week	-0.0031	0.0042	-0.74	0.460	-0.0113, 0.0051
	Minutes/session	-0.0002	0.0006	-0.33	0.739	-0.0014, 0.0010
	Intensity	0.0015	0.0104	0.14	0.885	-0.0189, 0.0219
30 m Sprint	Sessions/week	-0.0052	0.0051	-1.02	0.308	-0.0152, 0.0048
	Minutes/session	0.0003	0.0008	0.38	0.704	-0.0013, 0.0019
	Intensity	-0.0012	0.0121	-0.10	0.920	-0.0249, 0.0225
40 m Sprint	Sessions/week	-0.0028	0.0062	-0.45	0.652	-0.0150, 0.0094
	Minutes/session	0.0001	0.0011	0.09	0.928	-0.0021, 0.0023
	Intensity	0.0041	0.0154	0.27	0.787	-0.0261, 0.0343
Squat Jump (SJ)	Sessions/week	0.1245	0.0952	1.31	0.191	-0.0621, 0.3111
	Minutes/session	0.0084	0.0124	0.68	0.498	-0.0159, 0.0327
	Intensity	0.0521	0.1842	0.28	0.777	-0.3089, 0.4131
Countermovement Jump (CMJ)	Sessions/week	0.0982	0.0812	1.21	0.226	-0.0609, 0.2573
	Minutes/session	0.0062	0.0105	0.59	0.555	-0.0144, 0.0268
	Intensity	0.0415	0.1654	0.25	0.802	-0.2827, 0.3657
Change of Direction (COD)	Sessions/week	-0.0104	0.0084	-1.24	0.215	-0.0269, 0.0061
	Minutes/session	-0.0001	0.0004	-0.25	0.803	-0.0009, 0.0007
	Intensity	0.0045	0.0182	0.25	0.805	-0.0312, 0.0402
Maximal Strength (1RM)	Sessions/week	1.3125	0.8421	1.56	0.119	-0.3380, 2.9630
	Minutes/session	0.1560	0.1245	1.25	0.211	-0.0880, 0.4000
	Intensity	0.8842	1.4521	0.61	0.542	-1.9619, 3.7303

This table presents a comprehensive network meta-regression analysis to evaluate potential effect modifiers related to training dosage across eight performance outcomes. Variables including training frequency (Sessions/week), session duration (Minutes/session), and training intensity were analyzed to assess their impact on intervention efficacy and ensure the assumption of transitivity across the varied training volumes (1–16 weeks). Coefficients (Coef.) represent the change in Mean Difference (MD) per unit change in the modifier, with P-values in bold denoting statistical significance ($P < 0.05$). The lack of significant interaction for all training dosage variables across all eight outcomes (all $P > 0.05$) indicates that the comparative hierarchical rankings of the exercise modalities remain robust and stable regardless of variations in training exposure, further supporting the validity of the transitivity assumption within the studied range.

Supplementary Table S30. Global Inconsistency Assessment of the Network using the Design-by-Treatment Interaction Model

Outcome	Comparison	Coef.	Std. Err.	P> z	95% Conf. Low	95% Conf. High
5 m Sprint	Regular vs. Plyometric	0.011	0.015	0.463	-0.018	0.040
	Speed vs. Plyometric	-0.009	0.014	0.521	-0.036	0.018
	Strength vs. Plyometric	-0.015	0.020	0.453	-0.054	0.024
20 m Sprint	Flexibility vs. Endurance	0.012	0.112	0.915	-0.207	0.231
	Plyometric vs. Endurance	0.029	0.091	0.752	-0.149	0.207
	Regular vs. Endurance	0.052	0.090	0.562	-0.124	0.228
	Speed vs. Endurance	-0.040	0.080	0.618	-0.197	0.117
	Strength vs. Endurance	-0.108	0.112	0.335	-0.328	0.111
30 m Sprint	Flexibility vs. Endurance	0.031	0.150	0.836	-0.263	0.325
	Plyometric vs. Endurance	-0.010	0.186	0.957	-0.375	0.355
	Regular vs. Endurance	0.021	0.125	0.866	-0.224	0.266
	Speed vs. Endurance	-0.020	0.153	0.896	-0.321	0.281
	Strength vs. Endurance	0.070	0.272	0.797	-0.463	0.603
40 m Sprint	Regular vs. Endurance	0.020	0.153	0.896	-0.280	0.320
	Speed vs. Endurance	0.020	0.173	0.908	-0.318	0.358
	Strength vs. Endurance	0.065	0.170	0.704	-0.269	0.399
Squat Jump (SJ)	Regular vs. Plyometric	-0.199	3.185	0.950	-6.441	6.043
	Speed vs. Plyometric	-0.507	2.492	0.839	-5.392	4.377
	Strength vs. Plyometric	0.279	3.533	0.937	-6.645	7.203
Countermovement Jump (CMJ)	Flexibility vs. Endurance	1.188	3.121	0.703	-4.929	7.305
	Plyometric vs. Endurance	0.940	3.073	0.759	-5.083	6.963
	Regular vs. Endurance	-1.682	2.751	0.541	-7.074	3.711
	Speed vs. Endurance	1.405	3.411	0.680	-5.280	8.090
	Strength vs. Endurance	-0.386	1.886	0.838	-4.083	3.311
Change of Direction (COD)	Plyometric vs. Flexibility	0.060	0.089	0.501	-0.115	0.235
	Regular vs. Flexibility	-0.040	0.042	0.337	-0.122	0.042
	Speed vs. Flexibility	0.060	0.036	0.098	-0.011	0.131
	Strength vs. Flexibility	0.045	0.061	0.459	-0.074	0.164
Maximal Strength (1RM)	Regular vs. Plyometric	1.598	11.239	0.887	-20.431	23.627
	Speed vs. Plyometric	0.000	16.884	1.000	-33.093	33.093
	Strength vs. Plyometric	2.532	11.477	0.825	-19.962	25.026

Supplementary Table S31. Estimated between-study heterogeneity (τ^2) for each outcome-specific network and 95% prediction intervals for key contrasts

Outcome	No. of studies	No. of interventions in network	Assumed heterogeneity structure	τ^2	Key contrast	MD (95% CI)	95% prediction interval
5-m sprint	10	4	Common τ^2 across comparisons within this outcome-specific network	0.0006	Traditional Strength Training vs Regular Training	-0.09 (-0.11, -0.07)	-0.13 to -0.05
20-m sprint	13	6	Common τ^2 across comparisons within this outcome-specific network	0.0018	Traditional Strength Training vs Regular Training	-0.13 (-0.20, -0.06)	-0.26 to 0.00
30-m sprint	13	6	Common τ^2 across comparisons within this outcome-specific network	0.0032	Speed Training vs Regular Training	-0.16 (-0.34, 0.01)	-0.42 to 0.10
40-m sprint	8	4	Common τ^2 across comparisons within this outcome-specific network	0.0041	Endurance Training vs Regular Training	-0.21 (-0.45, 0.03)	-0.56 to 0.14
SJ	15	5	Common τ^2 across comparisons within this outcome-specific network	5.92	Traditional Strength Training vs Regular Training	4.40 (2.07, 6.74)	-0.02 to 8.82
CMJ	28	6	Common τ^2 across comparisons within this outcome-specific network	4.68	Traditional Strength Training vs Regular Training	3.58 (2.00, 5.15)	0.11 to 7.05
COD	17	5	Common τ^2 across comparisons within this outcome-specific network	0.0054	Traditional Strength Training vs Regular Training	0.13 (0.08, 0.18)	0.01 to 0.25
1RM	16	4	Common τ^2 across comparisons within this outcome-specific network	16.74	Traditional Strength Training vs Regular Training	20.86 (10.73, 30.98)	1.84 to 39.88

Network meta-analyses were conducted separately for each outcome. For each outcome-specific network, a common between-study heterogeneity variance (τ^2) was assumed across all treatment comparisons and estimated under a random-effects model. The term “multivariate” refers to the contrast-based formulation implemented in the Stata network suite for treatment comparisons within a given outcome network, rather than to a joint model across different outcomes. Key contrasts were selected according to the most decision-relevant comparisons reported in the main text, generally contrasting the highest-ranked intervention against Regular Training. For sprint outcomes, negative mean differences indicate faster sprint times. For SJ, CMJ, and 1RM, positive mean differences indicate better performance. For COD, the direction is presented as reported in the current manuscript and should be interpreted accordingly.

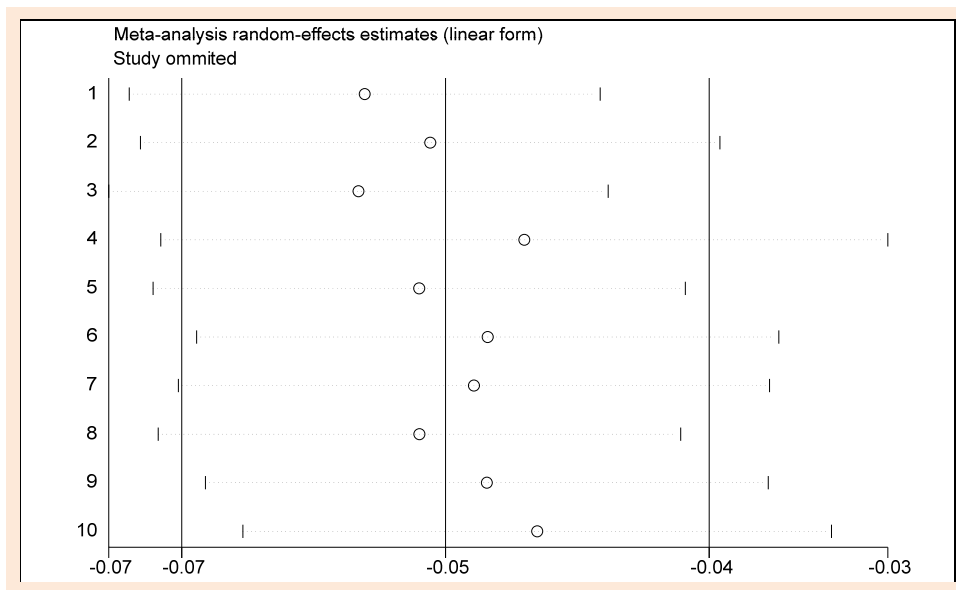
Supplementary Table S32. Summary of sprint testing characteristics relevant to measurement comparability among studies contributing sprint outcomes

Study	Sprint distance(s)	Timing method (brief)	Start/surface notes	Classification
Gao F.	30 m	My Sprint App	Crouched 3-point start; grass football pitch	Video/app-based
Little T.	20 m	Video-camera analysis	Not reported	Video/app-based
Sayers A.L.	30 m	Photocells	Static self-selected start; outdoor tartan track	Electronic/photo-electric
Hostrup M.	30 m	Not reported	Not reported	Unclear
Nobari H.	20 m and 30 m	Timing gates	Start not reported; third-generation AstroTurf	Electronic/photo-electric
Wallenta C.	5 m	Photocells	Standing start, 0.5 m behind first gate; outdoor artificial turf	Electronic/photo-electric
Rønnestad B.R. (2011)	40 m	Photocells	Standing start, 0.5 m behind first gate; outdoor artificial turf	Electronic/photo-electric
Rønnestad B.R. (2008)	30 m	Photocells	Standing start, 0.5 m behind first gate; outdoor artificial turf	Electronic/photo-electric
Rey E.	30 m	Electronic timing gates	Standing start, 0.5 m behind first gate; artificial turf	Electronic/photo-electric
López-Segovia M.	20 m and 30 m	Not reported	Not reported	Unclear
Gee T.I.	40 m	Double-light barriers	Self-selected start, 0.75 m before first barrier; surface not clearly reported	Electronic/photo-electric
Pareja-Blanco F.	30 m	Photocells	Stationary start; surface not clearly reported	Electronic/photo-electric
Loturco I. (2015)	5 m	Electronic timing gates	Stationary start for 10 m; flying/maximal-speed start for 20 m; indoor synthetic pitch	Electronic/photo-electric
Loturco I. (2017)	5 m, 20 m, and 30 m	Photocells	Standing start; natural grass	Electronic/photo-electric
Iaia F.M.	20 m and 40 m	Photocells	Standing position, 0.3 m behind start line; indoor running track	Electronic/photo-electric
Kobal R.	20 m	Photoelectric timing gates	Parallel standing start, 0.3 m behind line; grass soccer pitch	Electronic/photo-electric
Keiner M.	20 m	Electronic timing gates/photocells	Split-legged stance, 70 cm behind first photocells; surface not clearly reported	Electronic/photo-electric
Milanović Z.	20 m	Not reported	Start not reported; surface not clearly reported	Unclear
Bettariga F.	5 m, 20 m, and 30 m	Infrared photoelectric cells	Standing start, 0.5 m before first gate; indoor court	Electronic/photo-electric
Silva-Neto M.E.	30 m	Photocells	Standing/static start; front foot 50 cm behind line; indoor hard/even surface or indoor sprint track	Electronic/photo-electric
Dupont G.	40 m	Photocells	Standing start, 30 cm behind first photocell; hard even indoor surface	Electronic/photo-electric
McMorrow B.J.	5 m and 20 m	Photoelectric cells	Self-determined start, 0.5 m before first gate; artificial grass	Electronic/photo-electric
Hammami M. (2017)	5 m, 20 m, 30 m, and 40 m	Automated timing device with pressure pad and electronic gates	Standing start; lead foot on pressure pad; indoor artificial playing surface	Electronic/photo-electric
Hammami M. (2018a)	5 m and 40 m	Not clearly reported	Not reported	Unclear
Hammami M. (2018b)	5 m, 20 m, 30 m, and 40 m	Electronic photocells	Standing start, 0.5 m behind first gate; natural grass	Electronic/photo-electric
Hammami M. (2020)	5 m, 20 m, 30 m, and 40 m	Not reported	Not reported	Unclear

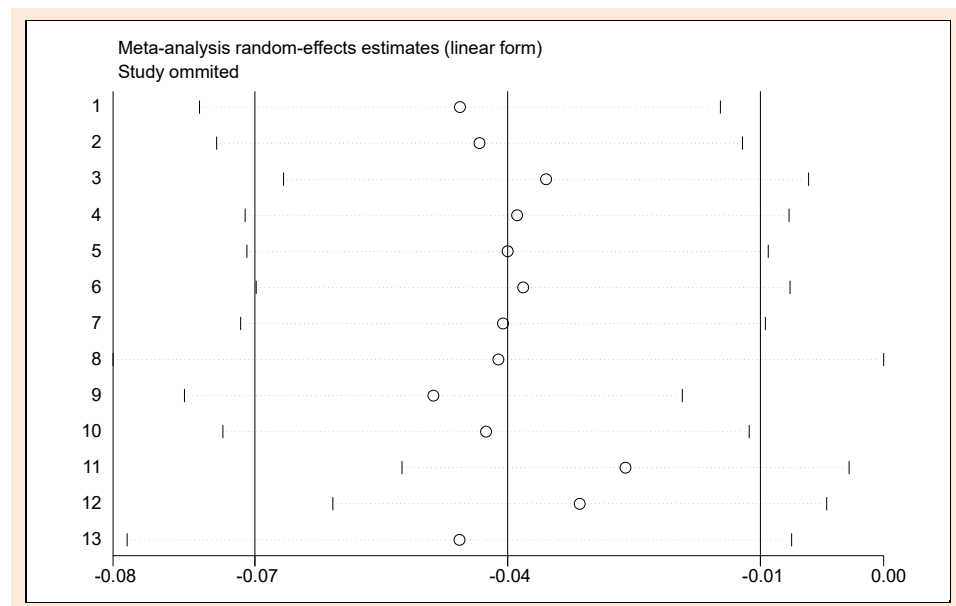
Supplementary Table S33. Timing-method sensitivity analysis for sprint outcomes.

Outcome	Main analysis: key contrast (MD, 95% CI)	Sensitivity analysis excluding non-photoelectric/electronic timing studies: key contrast (MD, 95% CI)	Interpretation
5-m sprint	Traditional Strength Training vs Regular Training: -0.09 s (-0.11 to -0.07)	-0.09 s (-0.11 to -0.07)	Unchanged; conclusion robust
20-m sprint	Traditional Strength Training vs Regular Training: -0.13 s (-0.20 to -0.06)	-0.13 s (-0.19 to -0.05)	Materially unchanged; conclusion robust
30-m sprint	Speed Training vs Regular Training: -0.16 s (-0.34 to 0.01)	-0.14 s (-0.31 to 0.03)	Direction preserved, but imprecision remained; no statistical significance
40-m sprint	Endurance Training vs Regular Training: -0.21 s (-0.45 to 0.03)	-0.18 s (-0.41 to 0.05)	Direction preserved, but uncertainty remained; no statistical significance

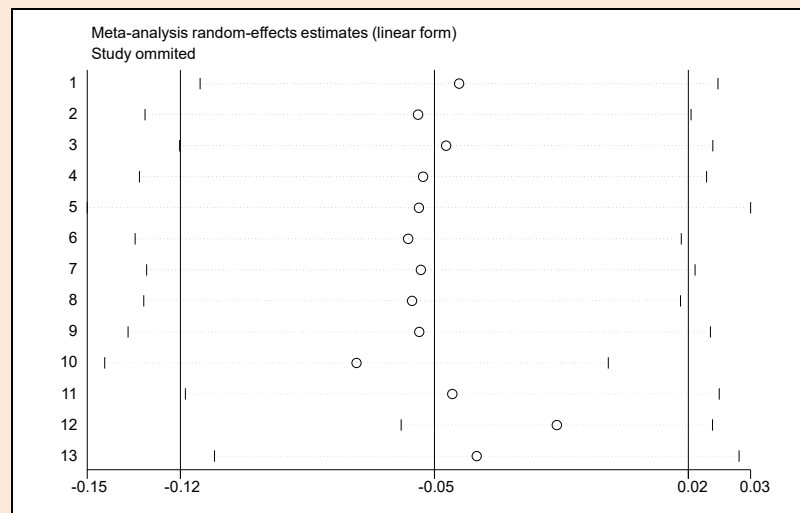
For sprint outcomes, the sensitivity analysis excluded studies using video/app-based timing methods, while studies with unclear timing-method reporting were retained to avoid excessive fragmentation of sparse networks. Key contrasts were selected to match the most decision-relevant comparisons reported in the main text. For sprint outcomes, negative MDs indicate faster sprint times.



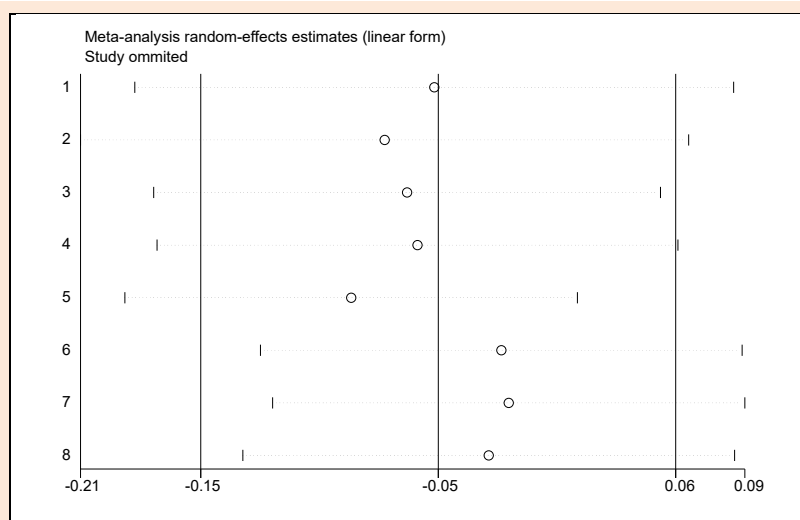
Supplementary Figure S10. Sensitivity analysis for the 5-m sprint outcome.



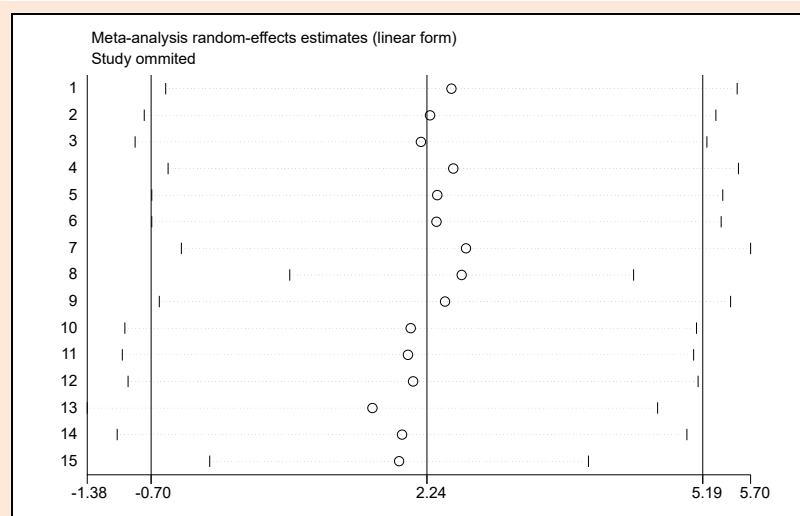
Supplementary Figure S11. Sensitivity analysis for the 20-m sprint outcome.



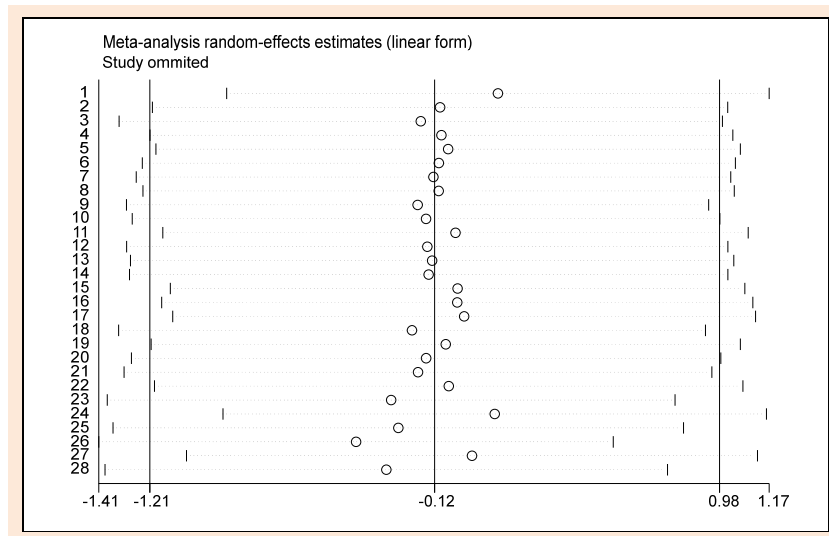
Supplementary Figure S12. Sensitivity analysis for the 30-m sprint outcome.



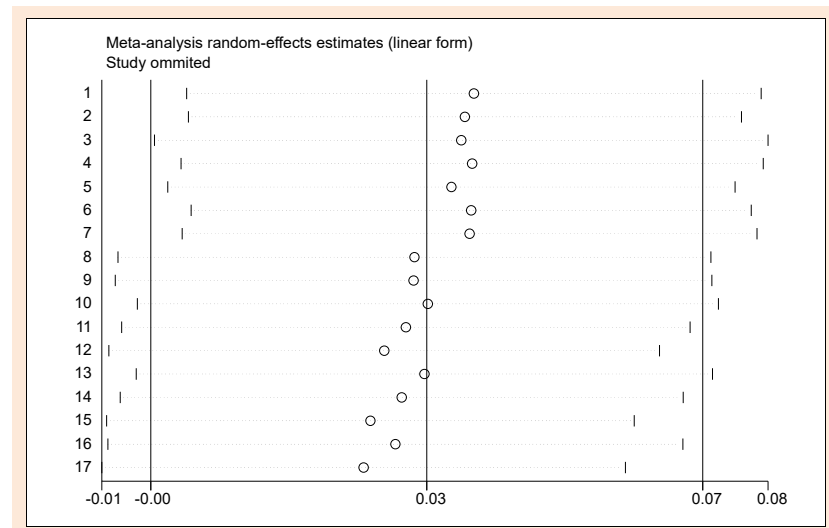
Supplementary Figure S13. Sensitivity analysis for the 40-m sprint outcome.



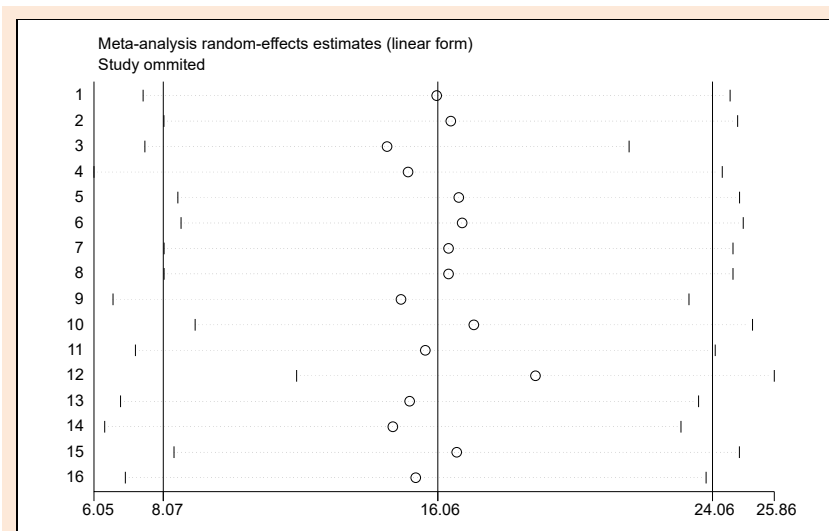
Supplementary Figure S14. Sensitivity analysis for the SJ outcome.



Supplementary Figure S15. Sensitivity analysis for the CMJ outcome.



Supplementary Figure S16. Sensitivity analysis for the COD outcome.



Supplementary Figure S17. Sensitivity analysis for the 1RM outcome.