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Comparative Effects of Training Modalities on Countermovement Jump Performance in Soccer Players: A Systematic Review and Network Meta-Analysis

Xusong Dong [1], Tao Li [2], Weihuan Xing [3] and Zezhao Chen [1]

[1] School of Strength and Conditioning Training, Beijing Sport University, Beijing, China; [2] School of Chinese Basketball, Beijing Sport University, Beijing, China; [3] School of Strength and Conditioning Training, Beijing Sport University, Beijing, China

Supplementary Materials

S1. PRISMA Checklist

Table S1. PRISMA 2020 Checklist.

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Title page
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Abstract
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Introduction
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Introduction
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Study selection
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Search Strategy
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Search Strategy
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Study selection
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Study selection
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Results – Primary outcome (CMJ performance)
	10b	List and define all other variables for which data were sought (e.g., participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Results – Study characteristics
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Risk of bias and evidence quality assessment
Effect measures	12	Specify for each outcome the effect measure(s) (e.g., risk ratio, mean	Statistical

		difference) used in the synthesis or presentation of results.	Analysis
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Methods – Study characteristics and network structure
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Statistical Analysis
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Statistical Analysis
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model (s), method (s) to identify the presence and extent of statistical heterogeneity, and software package (s) used.	Statistical Analysis
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Statistical Analysis
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Sensitivity analysis
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Risk of bias and evidence quality assessment
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Risk of bias and evidence quality assessment
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure S1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Figure S1
Study characteristics	17	Cite each included study and present its characteristics.	Characteristics of included studies
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Risk of bias and credibility assessment
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Results – Network estimates
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Risk of bias and credibility assessment

	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Network meta-analysis
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Additional analyses
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Sensitivity analysis
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Risk of bias and credibility assessment
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Network meta-analysis
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Discussion
	23b	Discuss any limitations of the evidence included in the review.	Limitations
	23c	Discuss any limitations of the review processes used.	Limitations
	23d	Discuss implications of the results for practice, policy, and future research.	Clinical implications and directions for future research
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Methods
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Methods
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Methods
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Funding statement
Competing interests	26	Declare any competing interests of review authors.	Conflict of interest
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Availability of data and material

S2. Search Strategy

Table S2. PubMed search strategy.

Search	Strategy	Date	Number
#1	((((((((((((((((Exercises[MeSH Terms]) OR (Exercise, Physical[MeSH Terms])) OR (Exercises, Physical[MeSH Terms])) OR (Physical Exercise[MeSH Terms])) OR (Physical Exercises[MeSH Terms])) OR (Exercise, Isometric[MeSH Terms])) OR (Exercises, Isometric[MeSH Terms])) OR (Isometric Exercises[MeSH Terms])) OR (Isometric Exercise[MeSH Terms]))) OR (Exercise Training[MeSH Terms])) OR (Exercise Trainings[MeSH Terms])) OR (Training, Exercise[MeSH Terms])) OR (Trainings, Exercise[MeSH Terms])) OR (Physical Activity[MeSH Terms])) OR (Activities, Physical[MeSH Terms])) OR (Activity, Physical[MeSH Terms])) OR (Physical Activities[MeSH Terms])	28 November 2025	319809
#2	soccer OR football	28 November 2025	43594
#3	(((jump) OR (power)) OR (standing long jump)) OR (countermovement jump)	28 November 2025	619471
#4	("Randomized Controlled Trial" [Publication Type]) OR (RCTs[Title/Abstract])	28 November 2025	722735
#5	#1 AND #2 AND #3 AND #4	28 November 2025	518

Table S3. The EBSCO search strategy.

Search	Strategy	Date	Number
#1	SU (training) OR SU (exercise) OR SU (isometric exercise) OR SU (physical activity) OR SU (physical exercise)	28 November 2025	813489
#2	SU soccer OR SU football	28 November 2025	8610137
#3	SU (standing long jump) OR jump OR power	28 November 2025	913643
#4	TX (Randomized Controlled Trial OR RCT OR RCTs OR Randomized trial OR Randomized clinical trial OR Clinical trial, randomized OR Randomized controlled studies OR Random allocation OR Random assignment OR Controlled trial, randomized OR Trial, randomized controlled OR Randomized experimental trial)	28 November 2025	1812063
#5	#1 AND #2 AND#3 AND #4	28 November 2025	1149

Table S4. Web of Science search strategy.

Search	Strategy	Date	Number
#1	exercise (Topic) or physical exercises (Topic) or training (Topic) or isometric exercise (Topic) or exercise training (Topic) or physical activity (Topic) or training activity (Topic)	28 November 2025	15066794
#2	Soccer（All Fields） OR football(All Fields)	28 November 2025	64079
#3	jump (All Fields) or power (All Fields)	28 November 2025	1788975
#4	Randomized Controlled Trial (Topic) or RCTs (Topic)	28 November 2025	409127
#5	#1 AND #2 AND #3 AND #4	28 November 2025	327

Table S5. Embase search strategy.

Search	Strategy	Date	Number
#1	'exercise'/exp OR 'exercise' OR 'physical activity':ti,ab,kw OR 'isometric exercise':ti,ab,kw OR 'training':ti,ab,kw	28 November 2025	1788417
#2	soccer OR football	28 November 2025	37438
#3	'power'/exp OR 'power' OR 'jumping'	28 November 2025	666047
#4	randomized controlled trial OR randomly OR controlled clinical trial OR randomized OR random allocation OR placebo OR single-blind method OR double-blind method OR trials OR comparators OR allocation	28 November 2025	1447918
#5	#1 AND #2 AND #3 AND #4	28 November 2025	265

Table S6. Cochrane Library search strategy.

Search	Strategy	Date	Number
#1	(exercises, Isometric):kw OR ("exercise"):kw OR (training):kw OR ("physical activity"):kw OR ("physical exercise"):kw	28 November 2025	112968
#2	(jump) OR (power)	28 November 2025	61590
#3	soccer OR football	28 November 2025	4441
#4	(Randomized Controlled Trial or RCT or RCTs or Randomized trial or Randomized clinical trial or Clinical trial, randomized or Randomized controlled studies or Random allocation or Random assignment or Controlled trial, randomized or Trial, randomized controlled or Randomized experimental trial):ti,ab,kw	28 November 2025	1048510
#5	#1 AND #2 AND #3 AND #4	28 November 2025	393

Although the search strategy included general team-sport related terms to maximize sensitivity, only studies involving soccer players were eligible for inclusion during the screening process.

S3. Classification of Interventions

Table S7 summarizes the CMJ assessment devices reported in the included studies. The identified assessment methods included force platforms, optical systems (e.g., OptoJump/Optogait), contact mats, and smartphone-based applications.

Study (Year)	CMJ Assessment Device
Barra-Moura (2024)	Chronojump Bosco System
Dhull (2025)	Chronojump Bosco System
Gallego-Sendarrubias (2021)	Chronopump-Boscosystem DIN-A2
Gómez (2023)	My Jump 2
Liu (2024)	MyJump 2
Nonnato (2022)	OptoJump (Microgate, Bolzano, Italy)
Quan (2024)	PASCO Force Platform (PS-2142)
Sagelv (2020)	Hurlab FP4 Force Platform (HUR Labs, Finland)
Sammoud (2024)	Optojump (Microgate, Italy)
Yang (2025)	MyJump 2
Zhu (2025)	MyJump 2
Brahim (2025)	OptoJump System (Microgate, Italy)
Sedano Campo (2009)	SportJUMP System
Fischetti (2019)	Optojump Next System
Maciejczyk (2021)	Optojump System
Ozbar (2014)	Ergojump (Globus, Italy)
Sperlich (2011)	Kistler Force Platform*
Ferrari Bravo (2008)	QuattroJump Kistler Force Platform
Mujika (2009)	Ergo Tester Contact Platform (Globus Italia)
Tønnessen (2011)	ErgoJump Contact Platform
Pecci (2023)	Optogait System
Sanchez-Sanchez (2019)	Globus Ergo System®
Buchheit (2010)	Optojump (Microgate, Italy)
Los Arcos (2015)	Optojump (Microgate, Spain)
Hammami (2019)	Quattro Jump Force Platform (Kistler Instrument AG, Winterthur, Switzerland)
McKinlay (2018)	OptoJump (Microgate, Bolzano, Italy)
Vera-Assaoka (2020)	OptoJump System†
de Hoyo (2015)	Optojump System (Microgate, Italy)
Coratella (2019)	OptoJump System

Note：Device information was not completely described in the article; identification was based on the testing procedures reported. Studies including youth, collegiate, and professional soccer players were considered eligible in order to enhance the generalizability of the findings across different competitive levels.

Table S8. Classification of primary exercise mode Intervention Indicators.

Abbreviation	Full name	Definitions	Classification Basis
CBT	Combined training	Combined Training is a structured approach that integrates two or more types of exercise within the same training cycle or session to simultaneously develop multiple physical qualities (e.g., strength and endurance, power and agility). Its core aim is to enhance overall performance while minimizing interference effects between training modalities.	Based on previous literature, combined training is defined as a training methodology that integrates resistance and plyometric exercises within a single training program or microcycle, aiming to optimize strength, power, and overall athletic performance (e.g., Oliver et al., 2024; Zhao et al., 2026).
STG	Traditional Strength Training	Traditional Strength Training involves structured exercises using weights, machines, or body weight to build strength, endurance, and muscle mass through controlled movements, multiple sets, and progressive overload for muscle adaptation and performance improvement.	Based on previous resistance-training literature (e.g., Suchomel et al., 2016; Kraemer and Ratamess, 2004; Haff and Triplett, 2016), structured strength exercises using free weights, machines, or body weight aimed at improving maximal strength, muscular endurance, and neuromuscular performance were collectively classified as traditional strength training (STG).
PT	Plyometric Training	Plyometric training involves power movements like jumps and bounds to enhance power, speed, and neuromuscular efficiency. It utilizes the stretch-shortening cycle to improve athletic performance, agility, and reactive strength through rapid force production.	Consistent with previous studies (e.g., Markovic and Mikulic, 2010; Ramirez-Campillo et al., 2018; Asadi et al., 2016), explosive exercises utilizing the stretch–shortening cycle (e.g., jumps, hops, and bounds) designed to enhance power, speed, and reactive strength were collectively classified as plyometric training (PT).
FT	Flywheel Resistance Training	Flywheel Resistance Training uses rotating inertial discs to provide variable resistance during both concentric and eccentric muscle actions. It emphasizes eccentric overload by requiring athletes to decelerate the spinning flywheel, thereby increasing mechanical tension and neuromuscular activation. This training modality enhances strength, power, and explosive performance by dynamically adjusting resistance based on the force applied throughout the range of motion.	Based on previous studies investigating flywheel resistance training in athletes (e.g., Tesch et al., 2017; Petré et al., 2018; Beato et al., 2019), exercises performed using inertial flywheel devices designed to provide variable resistance and eccentric overload were collectively classified as flywheel training (FT).

Abbreviation	Full name	Definitions	Classification Basis
SSG	Small-Sided Games	Small-Sided Games (SSG) training involves modified, smaller-team gameplay to enhance technical skills, tactical awareness, and physical conditioning. It improves decision-making, agility, and endurance by increasing player involvement, intensity, and game-specific movement patterns.	Based on previous studies examining small-sided games in soccer (e.g., Hill-Haas et al., 2011; Clemente et al., 2021; Owen et al., 2014), modified small-team game formats designed to replicate match-specific technical, tactical, and physiological demands were collectively classified as small-sided games (SSG).
RST	Repeated Sprint Training	Repeated Sprint Training involves performing multiple short maximal sprints with limited recovery between efforts. Its primary goal is to improve an athlete's ability to sustain high-intensity repeated efforts. This method enhances anaerobic performance, sprint capacity, and fatigue resistance, which are critical for soccer players during match situations requiring frequent high-speed actions.	Based on previous studies investigating repeated sprint ability and sprint training in team sports (e.g., Bishop et al., 2011; Buchheit and Laursen, 2013; Loturco et al., 2015), training protocols involving multiple short maximal sprints with brief recovery intervals were collectively classified as repeated sprint training (RST).
HIIT	High-Intensity Interval Training	High-intensity interval training alternates short bursts of intense exercise with low-intensity recovery periods. It enhances cardiovascular fitness, fat loss, and metabolic efficiency by maximizing effort in minimal time, promoting endurance and strength adaptations.	Consistent with previous studies on high-intensity interval training (e.g., Buchheit and Laursen, 2013; Helgerud et al., 2007; Iaia et al., 2009), exercise protocols characterized by repeated bouts of high-intensity effort interspersed with recovery periods were collectively classified as high-intensity interval training (HIIT).
TST	Traditional Soccer Training	Traditional soccer training is a form of advanced warm-up, followed by technical training of soccer dribbling, shooting, passing, tactical training, and full games, etc. It usually lasts 90-120 minutes and is a weekly training for all athletes.	

Note: Training modalities were classified based on their mechanical characteristics, physiological targets, and structural role within the training program. Resistance-based interventions included traditional strength training (STG), flywheel resistance training (FT), and combined training (CBT). Plyometric training (PT) was categorized separately due to its emphasis on the stretch–shortening cycle and explosive power development. Interval-based conditioning comprised High-Intensity Interval Training (HIIT) and repeated sprint training (RST), distinguished by their work-to-rest structure and sprint intensity profile. Small-sided games (SSG) were defined as reduced-player, game-based formats integrating technical-tactical elements with intermittent high-intensity demands. Traditional soccer training (TST) referred to structured technical and tactical field sessions within regular team practice. Primary exercise modes represented the dominant training stimulus under investigation, whereas secondary modes denoted complementary training components implemented alongside the primary intervention.

S4. Outcome Priority Hierarchy

Jump performance outcomes (priority hierarchy):

1. Countermovement Jump (CMJ), assessed without arm swing.

S5. Baseline Characteristics

Table S9. Baseline Characteristics of Participants (mean ± SD).

Author (Year)	Country	n	Sex	Age (years)	Body mass (kg)	Height (cm)	Competitive level	Outcomes
Barra-Moura (2024)	Brazil	21	M/F	15.3 ± 1.1	64.9 ± 0.7	175.4 ± 0.7	Youth players	CMJ
Dhull (2025)	India	30	M	22.9 ± 1.5	63.4 ± 6.0	174.0 ± 5.7	Highly trained players	CMJ
Gallego-Sendarrubias (2021)	Spain	24	M	25.5 ± 4.2	74.0 ± 7.5	180.0 ± 7.0	Semi-professional players	CMJ
Gómez (2022)	Spain	21	M	21.2 ± 3.0	74.4 ± 9.2	176 ± NA	Professional futsal players	CMJ
Liu (2023)	China	51	M	16.3 ± 0.6	62.3 ± 2.1	173.5 ± 2.9	Youth players	CMJ
Nonnato (2020)	UK	16	F	23 ± 4	60.3 ± 4.9	167 ± 3.7	Professional players	CMJ
Quan (2023)	China	21	M	17.7 ± 1.7	61.8 ± 4.7	170.9 ± 5.0	Collegiate players	CMJ
Sagelv (2021)	Norway	38	M	23.2 ± 2.6	80 ± 9	181 ± 5	Competitive players	CMJ
Sammoud (2019)	UK	27	M	12.3 ± 0.5	43.7 ± 6.4	151.7 ± 7.5	Youth players	CMJ
Yang (2023)	China	45	F	15.7 ± 0.5	57.6 ± 5.9	165.2 ± 5.2	Youth players	CMJ
Zhu (2024)	China	46	M	16.5 ± 0.5	68.7 ± 3.7	178.5 ± 4.5	Youth players (U-17)	CMJ
Brahim (2020)	Norway	32	M	19.1 ± 0.7	76.5 ± 4.6	181 ± 1	National youth players	CMJ
Sedano Campo (2013)	Spain	20	F	22.9 ± 2.7	57.7 ± 8.4	162 ± 6	Elite players	CMJ
Fischetti (2019)	Italy	28	F	26.6 ± 6.1	60.7 ± 5.5	160.4 ± 4.2	Adult female players	CMJ
Maciejczyk (2018)	Poland	15	F	19.6 ± 2.4	58.2 ± 9.6	163.1 ± 5.6	League players	CMJ
Ozbar (2014)	Turkey	18	F	18.2 ± 2.3	56.6 ± 7.0	161.3 ± 5.2	University players	CMJ
Sperlich (2011)	Sweden	17	M	13.5 ± 0.4	51.2 ± 9.1	160.2 ± 8.5	Elite academy players	CMJ
Ferrari Bravo (2008)	Italy	26	M	21.1 ± 5.1	73.2 ± 7.8	178.6 ± 5.0	Professional youth players	CMJ
Mujika (2009)	Italy	20	M	18.3 ± 0.6	71.4 ± 6.9	177 ± 4	Junior elite players	CMJ
Tønnessen (2011)	Norway	20	M	16.4 ± 0.9	67.2 ± 9.1	176.3 ± 7.4	Elite youth players	CMJ
Pecci (2018)	Spain	20	F	20.5 ± 2.6	58.7 ± 7.1	162.5 ± 4.8	Professional female players	CMJ
Sanchez-Sanchez (2018)	Spain	22	M	22.5 ± 2.2	72.6 ± 9.1	175.8 ± 7.1	Amateur players	CMJ
Buchheit (2010)	Australia	15	M	14.5 ± 0.5	64 ± 8	174 ± 10	Elite youth players	CMJ
Los Arcos (2015)	Spain	15	M	15.5 ± 0.6	68 ± 6	176 ± 6	Academy players	CMJ
Hammami (2019)	Tunisia	40	M	15.9 ± 0.3	58.7 ± 6.4	173 ± 6	Junior players	CMJ
McKinlay (2018)	Canada	41	M	12.5 ± 0.6	44.4 ± 8.1	155 ± 8	Youth players	CMJ
Vera-Assaoka (2020)	Chile	76	M	13.0 ± 1.5	45.8 ± 9.0	152 ± 11	Youth players	CMJ
de Hoyo (2016)	Spain	33	M	17.5 ± 1.0	72 ± 3	178 ± 2	Elite academy players	CMJ
Coratella (2019)	Italy	40	M	23 ± 4	77 ± 5	180 ± 11	Semi-professional players	CMJ

Note: Values are presented as mean ± standard deviation.

CMJ = countermovement jump.

Intervention Characteristics

Table S10. Training interventions in the included studies.

Author (Year)	Training intervention	Duration	Frequency
Barra-Moura (2024)	combined training (strength + sprint/jump drills)	8 weeks	3
Dhull (2025)	Isometric and dynamic combined training	8 weeks	2
Gallego-Sendarrubias (2021)	Percutaneous electrical neuromodulation combined with training	2 weeks	2
Gómez (2022)	High-intensity interval training with Nordic hamstring exercise	6 weeks	2
Liu (2023)	Micro-dose plyometric training integrated into soccer practice	6 weeks	4
Nonnato (2020)	Plyometric jump training	6 weeks	4
Quan (2023)	Small-sided games combined with high-intensity interval running	6 weeks	2
Sagelv (2021)	Flywheel resistance training	8 weeks	2
Sammoud (2019)	Plyometric training program	8 weeks	2
Yang (2023)	Small-sided game training with different player formats	6 weeks	2
Zhu (2024)	High-intensity interval and repeated sprint training	6 weeks	2
Brahim (2020)	Repeated sprint training	7 weeks	2
Sedano Campo (2013)	Plyometric training	12 weeks	3
Fischetti (2019)	Plyometric training	8 weeks	3
Maciejczyk (2018)	Plyometric training	6 weeks	2
Ozbar (2014)	Plyometric training	8 weeks	1~3
Sperlich (2011)	High-intensity interval training	7 weeks	3~4
Ferrari Bravo (2008)	High-intensity interval running training	7 weeks	2
Mujika (2009)	Repeated sprint training	6 weeks	1
Tønnessen (2011)	Repeated sprint training	8 weeks	1
Pecci (2018)	Field-based strength training	6 weeks	2
Sanchez-Sanchez (2018)	High-intensity interval running training	6 weeks	2
Buchheit (2010)	Repeated sprint training	6 weeks	1
Los Arcos (2015)	Small-sided game training	6 weeks	2
Hammami (2019)	Complex training (strength + plyometric)	8 weeks	4~5
McKinlay (2018)	Strength and plyometric combined training	8 weeks	3
Vera-Assaoka (2020)	Plyometric jump training	8 weeks	2
de Hoyo (2016)	Flywheel resistance training	6 weeks	1~2
Coratella (2019)	Flywheel resistance training	6 weeks	1

Note: Training protocols are summarised to present the main characteristics of the interventions included in the network meta-analysis.

S6. NMA Results

Heterogeneity

The global heterogeneity for jump performance was moderate ($\tau^2 = 0.8292$; $I^2 = 32.4\%$), suggesting acceptable variability across included comparisons.

Network Estimates

The network meta-analysis revealed that CBT and FT demonstrated moderate improvements in jump performance compared with TST. PT and RST showed small-to-moderate positive effects, whereas HIIT and SSG demonstrated trivial to small effects. Node-splitting analysis did not identify statistically significant incoherence between direct and indirect evidence ($p > 0.05$), indicating that the assumption of transitivity across the network was not violated.

Table S11. Heterogeneity results in network meta-analyses for jump**.**

Parameter	Value
τ^2	0.8292
τ	0.9106
I^2 (95% CI)	32.4% (0.0%–55.9%)

Tests of heterogeneity and inconsistency

Source	Q	df	p-value
Total	47.31	32	0.0398
Within designs	38.80	22	0.0149
Between designs	8.51	10	0.5790

Table S12. Publication bias and subgroup heterogeneity

Publication bias (funnel plot asymmetry)

Statistic	Value
t	-2.25
df	37
p-value	0.0305
Bias estimate	-0.6399
SE	0.2845

Subgroup heterogeneity

Subgroup	I^2
Male	31.5%
Female	0%
≤18 years	18.6%
>18 years	0%
T2	61.1%
T3	0%

Note： τ^2 represents the between-study variance and τ is the square root of τ^2. The I^2 statistic quantifies the proportion of total variability attributable to between-study heterogeneity. Q statistics were used to evaluate heterogeneity within and between study designs in the network meta-analysis. Funnel plot asymmetry was assessed using a linear regression test; a p-value <0.05 suggests potential publication bias.

Table S13. Node-splitting analysis results - jump

Comparison	k	prop	NMA TE	seTE	p	Direct TE	seTE	p	Indirect TE	seTE	p
CBT vs FT	0	0	1.739	1.292	0.178	NA	NA	NA	1.739	1.292	0.178
CBT vs HIIT	1	0.128	4.257	1.157	<0.001	0.100	3.228	0.975	4.870	1.239	<0.001
CBT vs PT	1	0.222	2.039	1.026	0.047	3.600	2.175	0.098	1.593	1.163	0.171
CBT vs RST	0	0	3.464	1.293	0.007	NA	NA	NA	3.464	1.293	0.007
CBT vs SSG	0	0	3.355	1.399	0.016	NA	NA	NA	3.355	1.399	0.016
CBT vs STG	1	0.302	3.316	1.148	0.004	0.500	2.090	0.811	4.532	1.373	<0.001
CBT vs TST	3	0.544	4.924	0.973	<0.001	6.168	1.320	<0.001	3.442	1.441	0.017
FT vs HIIT	1	0.216	2.518	1.107	0.023	2.900	2.381	0.223	2.413	1.250	0.054
FT vs PT	0	0	0.300	1.032	0.771	NA	NA	NA	0.300	1.032	0.771
FT vs RST	0	0	1.725	1.243	0.165	NA	NA	NA	1.725	1.243	0.165
FT vs SSG	0	0	1.616	1.374	0.240	NA	NA	NA	1.616	1.374	0.240
FT vs STG	3	0.688	1.577	0.886	0.075	1.756	1.068	0.100	1.180	1.586	0.457
FT vs TST	2	0.408	3.185	0.958	<0.001	2.679	1.501	0.074	3.534	1.245	0.005
HIIT vs PT	0	0	-2.218	0.834	0.008	NA	NA	NA	-2.218	0.834	0.008
HIIT vs RST	2	0.581	-0.793	0.907	0.382	-0.790	1.191	0.507	-0.798	1.401	0.569
HIIT vs SSG	2	0.553	-0.902	1.042	0.387	-0.556	1.402	0.691	-1.331	1.559	0.393
HIIT vs STG	0	0	-0.942	1.024	0.358	NA	NA	NA	-0.942	1.024	0.358
HIIT vs TST	4	0.569	0.667	0.716	0.352	0.207	0.949	0.827	1.274	1.091	0.243
PT vs RST	1	0.064	1.425	0.994	0.152	2.700	3.942	0.493	1.338	1.028	0.193
PT vs SSG	0	0	1.316	1.123	0.242	NA	NA	NA	1.316	1.123	0.242
PT vs STG	1	0.218	1.276	0.890	0.152	1.800	1.907	0.345	1.130	1.007	0.262
PT vs TST	10	0.912	2.885	0.450	<0.001	2.908	0.471	<0.001	2.645	1.520	0.082
RST vs SSG	0	0	-0.109	1.283	0.932	NA	NA	NA	-0.109	1.283	0.932
RST vs STG	1	0.221	-0.148	1.126	0.895	-1.700	2.396	0.478	0.292	1.276	0.819

RST vs TST	2	0.425	1.460	0.908	0.108	2.149	1.393	0.123	0.951	1.197	0.427
SSG vs STG	0	0	-0.039	1.296	0.976	NA	NA	NA	-0.039	1.296	0.976
SSG vs TST	2	0.582	1.569	1.034	0.129	1.893	1.356	0.163	1.119	1.599	0.484
STG vs TST	2	0.367	1.608	0.825	0.051	0.471	1.362	0.730	2.268	1.037	0.029

Note : *Node-splitting models were applied to evaluate potential inconsistency between direct and indirect evidence within the network. TE denotes the estimated treatment effect (mean difference), seTE indicates the standard error, and p represents the p-value for the inconsistency test. The variable "k" refers to the number of studies providing direct evidence, and "prop" represents the proportion of direct evidence contributing to the network estimate. "NA" indicates that no direct comparison was available. A p-value > 0.05 indicates no statistically significant inconsistency between direct and indirect estimates.* TST, Traditional Soccer Training; SSG, Small-Sided Games Training; RST, Repeated Sprint Training; PT, Plyometric Training; CBT, Combined Training; FT, Flywheel Resistance Training; STG, Traditional Strength Training; HIIT, High-Intensity Interval Training.

Table S14. League table of network meta-analysis results for jump performance (mean difference, 95% CI).

Comparison	NMA (MD, 95% CI)	p-value	Direct (MD, 95% CI)	p-value	Indirect (MD, 95% CI)	p-value
FT vs STG	1.577 (−0.160, 3.314)	0.075	1.756 (−0.336, 3.848)	0.100	1.180 (−1.927, 4.287)	0.457
FT vs TST	3.185 (1.307, 5.063)	<0.001	2.679 (−0.263, 5.621)	0.074	3.534 (1.094, 5.974)	0.005
HIIT vs PT	−2.218 (−3.852, −0.584)	0.008	NA	NA	−2.218 (−3.852, −0.584)	0.008
HIIT vs STG	−0.942 (−2.948, 1.064)	0.358	NA	NA	−0.942 (−2.948, 1.064)	0.358
HIIT vs TST	0.667 (−0.737, 2.071)	0.352	0.207 (−1.653, 2.067)	0.827	1.274 (−0.864, 3.412)	0.243
PT vs STG	1.276 (−0.468, 3.020)	0.152	1.800 (−1.937, 5.537)	0.345	1.130 (−0.844, 3.104)	0.262
PT vs TST	2.885 (2.003, 3.767)	<0.001	2.908 (1.985, 3.831)	<0.001	2.645 (−0.333, 5.623)	0.082

Values are presented as mean differences (MD) with 95% confidence intervals (CI).

Positive values favor the row-defining intervention, while negative values favor the comparator.

Direct and indirect estimates were obtained from pairwise and network meta-analysis models, respectively.

NA indicates that no direct comparison was available.

S7. Forest plot of subgroup analyses

Age subgroup

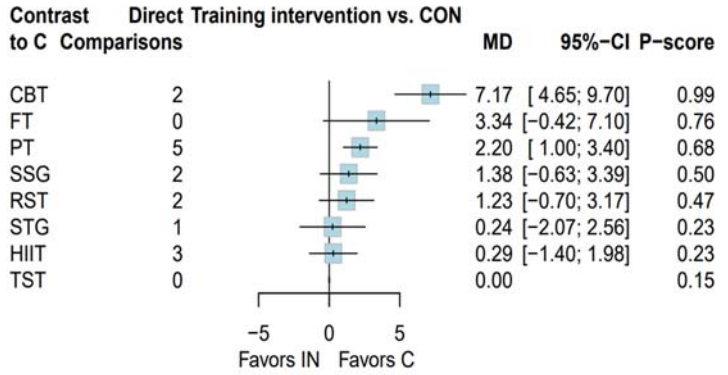

Figure S1. Subgroup analysis of training effects on CMJ performance in athletes aged ≤18 years.

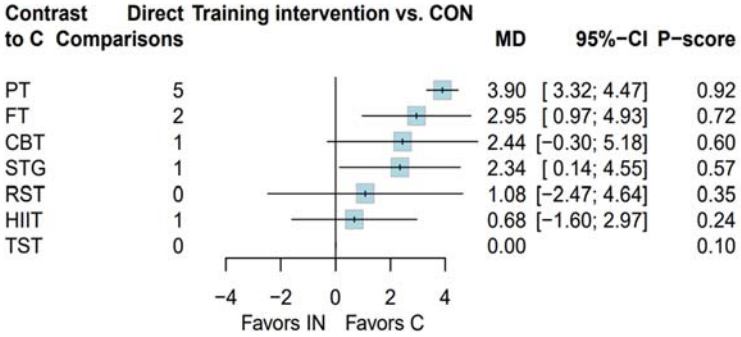

Figure S2. Subgroup analysis of training effects on CMJ performance in athletes aged >18 years.

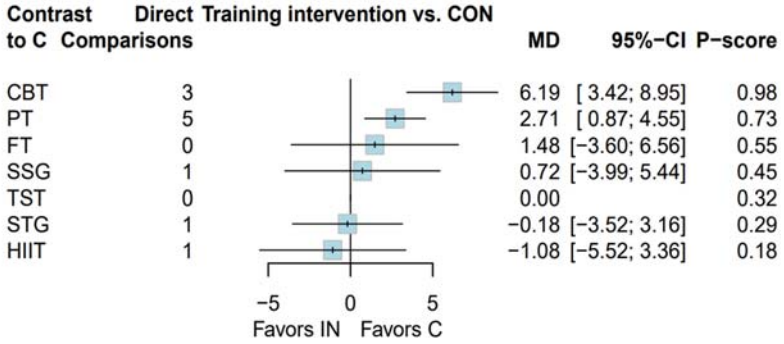

Figure S3. Subgroup analysis of training effects on CMJ performance according to training duration (T2).

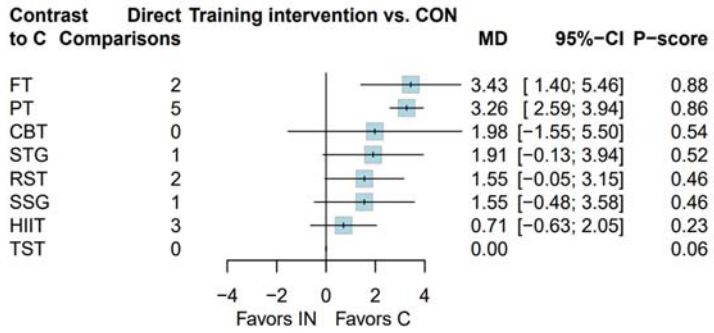

Figure S4. Subgroup analysis of training effects on CMJ performance according to training duration (T3).

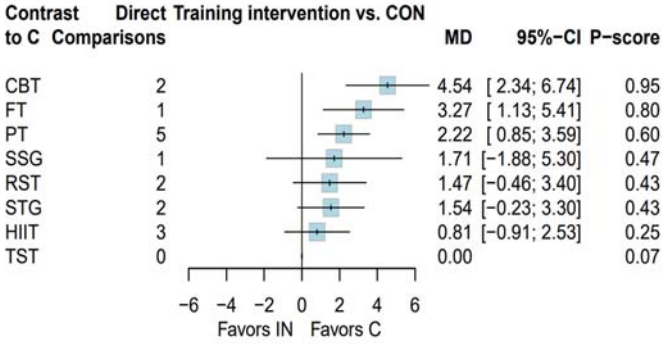

Figure S5. Subgroup analysis of training effects on CMJ performance in male.

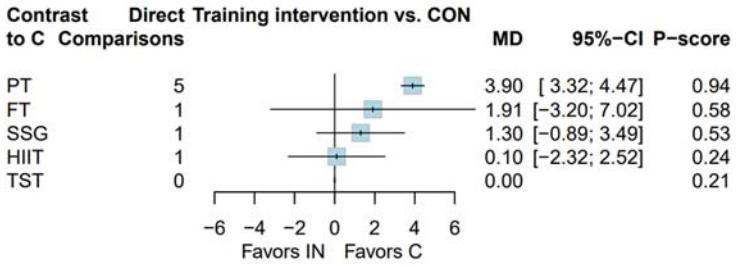

Figure S6. Subgroup analysis of training effects on CMJ performance in female.

Note：TST: Traditional soccer training; FT: Flywheel Resistance Training; STG: Traditional Strength Training; PT: Plyometric Training; CBT：Combined Training; SSG: Small-Sided Games Training; RST: Repeated Sprint Training; HIIT: High-Intensity Interval Training

S8. Risk of Bias

Most included studies were rated as low risk or had some concerns according to the RoB 2 tool, with no study classified as high risk across multiple domains. The most common source of bias arose from deviations from intended interventions and measurement procedures. However, overall methodological quality was considered acceptable for synthesis.

Table S15. The risk of bias assessment for the individual included studies.

Study	Bias arising from the randomization process	Bias due to deviations from intended interventions	Bias due to missing outcome data	Bias in measurement of the outcome	Bias in selection of the reported result	Overall risk of bias
Barra-Moura (2024)	Low	Low	Low	Low	Low	Low
Dhull (2025)	Low	Low	Low	Low	Low	Low
Gallego-Sendarrubias (2021)	Low	Some concerns	Low	Low	Low	Some concerns
Gómez (2022)	Low	Some concerns	Low	Low	Low	Some concerns
Liu (2023)	Low	Some concerns	Low	Some concerns	Low	Some concerns
Nonnato (2020)	Low	Some concerns	Low	Low	Low	Some concerns
Quan (2023)	Low	Some concerns	Low	Low	Low	Some concerns
Sagelv (2021)	Low	Some concerns	Low	Low	Low	Some concerns
Sammoud (2019)	Low	Low	Low	Low	Low	Low
Yang (2023)	Low	Some concerns	Low	Low	Low	Some concerns
Zhu (2024)	Low	Low	Low	Some concerns	Low	Some concerns
Brahim (2020)	Low	Some concerns	Low	Low	Low	Some concerns
Sedano Campo (2013)	Low	Some concerns	Low	Low	Low	Some concerns
Fischetti (2019)	Low	Some concerns	Low	Low	Low	Some concerns
Maciejczyk (2018)	Low	Some concerns	Low	Low	Low	Some concerns
Ozbar (2014)	Low	Some concerns	Low	Low	Low	Some concerns
Sperlich (2011)	Low	Some concerns	Low	Some concerns	Low	Some concerns
Ferrari Bravo (2008)	Low	Some concerns	Low	Low	Low	Some concerns
Mujika (2009)	Low	Some concerns	Low	Low	Low	Some concerns

Study	Bias arising from the randomization process	Bias due to deviations from intended interventions	Bias due to missing outcome data	Bias in measurement of the outcome	Bias in selection of the reported result	Overall risk of bias
Tønnessen (2011)	Low	Some concerns	Low	Low	Low	Some concerns
Pecci (2018)	Low	Some concerns	Low	Low	Low	Some concerns
Sanchez-Sanchez (2018)	Low	Some concerns	Low	Low	Low	Some concerns
Buchheit (2010)	Low	Some concerns	Low	Some concerns	Low	Some concerns
Los Arcos (2015)	Low	Some concerns	Low	Low	Low	Some concerns
Hammami (2019)	Low	Some concerns	Low	Low	Low	Some concerns
McKinlay (2018)	Low	Some concerns	Low	Low	Low	Some concerns
Vera-Assaoka (2020)	Low	Some concerns	Low	Low	Low	Some concerns
de Hoyo (2016)	Low	Some concerns	Low	Low	Low	Some concerns
Coratella (2019)	Low	Some concerns	Low	Low	Low	Some concerns

S9. CINeMA Assessment

The certainty of evidence ranged from low to moderate according to the CINeMA framework. Downgrading decisions were primarily driven by imprecision and within-study bias. Indirectness was not considered serious due to the homogeneity of population and outcome definitions.

No major incoherence or publication bias was detected in the primary comparisons.

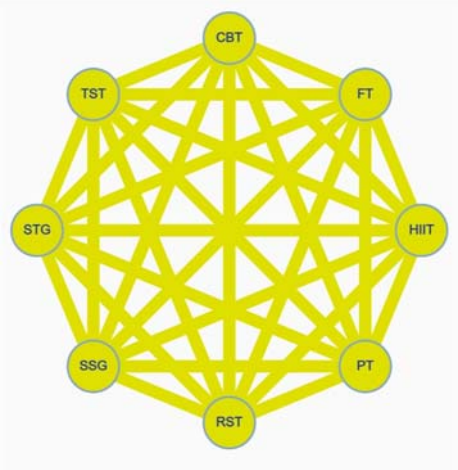

Figure S7. Summary and network plot of study limitations of the included studies.

Note**:** Node size by equal size, node color by RoB. The colors in the circles indicate the percentage of low RoB studies (green), moderate RoB studies (yellow), and high RoB studies (red) about each physical activity type. Edge width by sample size. Edge color by average RoB. The colors of the lines indicate the summative RoB assessment of each comparison. Low RoB is green, moderate RoB is yellow, and high RoB is red. TST: Traditional soccer training; FT: Flywheel Resistance Training; STG: Traditional Strength Training; PT, Plyometric Training; CBT, Combined Training; SSG: Small-Sided Games Training; RST: Repeated Sprint Training; HIIT: High-Intensity Interval Training

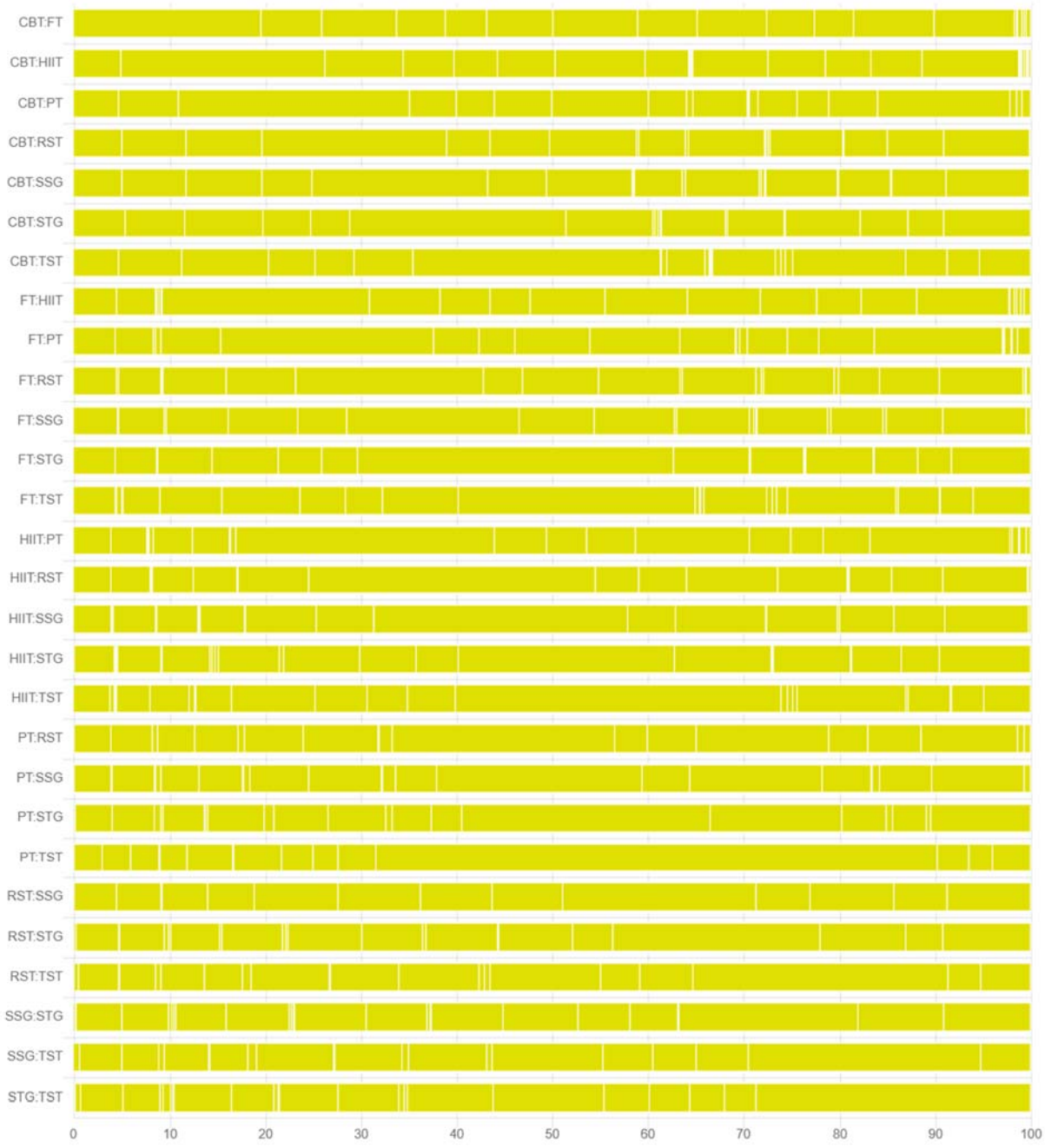

Figure S8. Risk Assessment of Different Interventions.

Note**:** *Risk of bias contributions: The bar chart shows the contributions of each piece of study to the network estimate. Contribution percentage of low, moderate, and high RoB comparisons to each network estimate. Low RoB is green, moderate RoB is yellow, and high RoB is red.*

Table S16. CINeMA for the primary outcome -CMJ

Comparison	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Confidence rating
CBT:FT	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
CBT:HIIT	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
CBT:PT	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
CBT:RST	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
CBT:SSG	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
CBT:STG	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
CBT:TST	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
FT:HIIT	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
FT:PT	No concerns	Some concerns	No concerns	Some concerns	No concerns	Low
FT:RST	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
FT:SSG	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
FT:STG	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
FT:TST	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
HIIT:PT	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
HIIT:RST	No concerns	Some concerns	No concerns	Some concerns	No concerns	Low
HIIT:SSG	No concerns	Some concerns	No concerns	Some concerns	No concerns	Low
HIIT:STG	No concerns	Some concerns	No concerns	Some concerns	No concerns	Low
HIIT:TST	No concerns	Some concerns	No concerns	Some concerns	No concerns	Low
PT:RST	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
PT:SSG	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
PT:STG	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
PT:TST	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
RST:SSG	No concerns	Some concerns	No concerns	Major concerns	No concerns	Very low
RST:STG	No concerns	Some concerns	No concerns	Major concerns	No concerns	Very low
RST:TST	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
SSG:STG	No concerns	Some concerns	No concerns	Major concerns	No concerns	Very low
SSG:TST	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate
STG:TST	No concerns	Some concerns	No concerns	No concerns	No concerns	Moderate