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Review Article

The Effectiveness of Mental Toughness Training in Athletes: A Systematic Review and Meta-analysis

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

Objectives. This study aimed to investigate the effectiveness of interventions targeting mental toughness (MT) in sport.

Materials and Methods. Eligibility criteria encompassed quantitative controlled experimental studies of MT interventions in athletes. Information sources comprised studies indexed in Web of Science, PubMed, Scopus, Embase, and SPORTDiscus from inception to April 13, 2025. Reference lists of included studies were also screened. Risk of bias was considered as follows: Two authors independently assessed the reporting quality and risk of bias of included studies using a modified Downs and Black index. Regarding the synthesis of results, the standardized mean difference (SMD) was calculated to evaluate the effects of interventions using the random effect model.

Results. This review included a total of 10 studies involving 465 participants, with sports primarily including soccer (24.7%), basketball (19.7%), and table tennis (17.5%). Seven studies (67.3%) employed a combination of psychological skills training interventions. The meta-analysis incorporated all 10 studies and their respective experimental groups to elucidate the overall efficacy of MT training programs. The pooled effect size was statistically and practically significant, yielding a large standardized mean difference of $g = 0.81$ (95% CI 0.57–1.05, $p < 0.001$), indicating a substantial advantage of MT training interventions over control conditions.

Conclusions. This meta-analysis provides strong empirical evidence supporting the effectiveness of psychological interventions — particularly multicomponent Psychological Skills Training (PST) — in enhancing mental toughness among athletes across different sports. However, due to the lack of long-term follow-up assessments, reliance on quasi-experimental designs, and diversity in measurement approaches, the findings should be interpreted with caution. To advance the field, further research should adopt more rigorous methodologies, including large-scale randomized controlled trials and longitudinal designs, to identify the most effective components and delivery methods for developing mental toughness. These efforts will ultimately inform evidence-based practices for coaches, psychologists, and practitioners aiming to cultivate high-performing athletes.

Keywords: mental toughness, psychological skills training, athletes, intervention.

Introduction

Over the past few decades, sports researchers have been dedicated to exploring the concept of mental toughness, aiming to gain a deeper understanding of individuals who can consistently deliver high – level performances in challenges, stress, or adversity (Konter et al., 2019). To enhance comprehension of mental toughness, studies employing quantitative or qualitative methods have been conducted across various sports categories. These efforts have led to updates and more empirical advances in the conceptual construction (e.g., Jones et al., 2002; Clough et al., 2002; Gucciardi et al., 2008), assessment tools (e.g., Clough et al., 2002; Sheard et al., 2009), and effectiveness of mental toughness (e.g., Clough & Strycharczyk, 2012; Mahoney et al., 2014). Since the millennium, the growing research interest, driven by the potential link between mental toughness and successful performance, has clearly reflected the value placed on this concept by sport psychologists, coaches, and athletes.

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Mental toughness training is crucial for enhancing athletes' psychological qualities. Research indicates that the cultivation of mental toughness a nonlinear, long-term process driven by a continuous interaction between individuals (training, experiential learning), society, and the environment (support systems) (Connaughton et al., 2008). Studies based on interviews and analyses have shown that factors such as the sporting process, interpersonal relationships within and beyond sports, and the broader family and social environment all contribute to the development of mental toughness, through the navigation of both positive and adverse experiences (Thewell et al., 2010). In addition, coaches play a key role in psychological resilience training. They can boost athletes' mental toughness by creating a positive training environment and teaching mental strategies such as goal – setting, visualization, positive self – talk, and mental rehearsal (Butt et al., 2010). Prior research has underscored the importance of cultivating independence and adaptability in young athletes within an environment that is both supportive and challenging (Cook et al., 2014). Through a systematic review focusing on studies in athletic and competitive contexts, an integrated framework was proposed, positing that mental toughness arises from the dynamic interactions among individual attributes, contextual systems, and participation in progressively challenging activities as a long-term process (Anthony et al., 2016). Building on this, subsequent studies proposed coach-targeted educational programs that integrate mental toughness theory with the GROW model to facilitate the development of mental toughness among elite athletes (Anthony et al., 2018). From the perspective of sport psychology, it has been suggested that coaches can effectively enhance athletes' mental toughness by exposing them to challenging situations and teaching relevant psychological skills (Weinberg et al., 2016). Furthermore, research emphasizes the need for coaches to adopt intentional strategies in fostering mental toughness—taking into account individual athlete differences, promoting autonomy, and creating environments that are simultaneously supportive and demanding (Weinberg et al., 2018).

However, most studies are limited to qualitative interviews or quantitative cross – sectional designs. The lack of evidence – based information on effective developing and sustaining mental toughness training strategies has hindered the progress of mental toughness training practices (Stamatis et al., 2020). Therefore, a systematic summary and evaluation of the effectiveness of empirically – tested mental toughness interventions in sports is necessary.

There is no denying that some narrative and systematic reviews have been published to explore various strategies for developing mental toughness (MT) and offering insights and support for relevant practices. However, these reviews predominantly focus on qualitative research, cross-sectional studies, or the integration of mixed-methods observational research with quantitative experimental studies (e.g., Crust & Clough, 2011; Anthony et al., 2016; Stamatis et al., 2020). Guided by PRISMA standards, this review centers on quantitative experimental research concerning mental toughness interventions. It aims to conduct a systematic review and meta-analysis of all available empirical evidence regarding the effectiveness of MT training. By doing so, it seeks to provide guidance for potential recommendations that can help practitioners and researchers design and evaluate evidence-based MT training programs. Thus, this study intends to systematically review and meta – analyze existing evidence to address the research question of whether there are valid and empirical interventions for sport MT training.

Materials and methods

Eligibility criteria

After an initial search for relevant literature, the author team drafted and revised the eligibility criteria. Following the Population, Intervention, Comparison, Outcome, and Study design (PICOS) principles, the study selection criteria were as follows:

Population: Participants included athletes of any age or gender involved in a sport who received varying levels of mental toughness (MT) interventions. These athletes originated from two types of studies: those that specifically employed psychological and/or physical methods to enhance athletes' MT levels, and those that assessed MT changes as a byproduct of athletic training protocols not necessarily targeting MT.

Intervention: MT interventions broadly encompassed any psychological and/or physical strategies prescribed to athletes to influence their MT levels. There were no restrictions on the type, components, frequency, or duration of the training.

Comparison: The comparison focused on the differences between a control group and an experimental group in outcome variables resulting from the interventions.

Outcome: Studies were required to include outcome measures related to MT. These outcome measures were obtained through pre – and post – tests (including self – report tools specifically designed to measure MT and other tools used by researchers to infer athletes' MT levels).

Study design: This protocol involved quantitative pre- and post – test experimental studies aimed at investigating the effects of MT interventions on athletes' MT levels. Both randomized controlled trials and non – randomised studies (e.g., quasi – experimental designs) were considered, while Case studies and single-arm studies were excluded. There was no publication date limitation, but the studies were restricted to English – language papers.

Information Sources

The authors searched the following five electronic databases to identify relevant studies: Web of Science, PubMed, Scopus, Embase, and SPORTDiscus. Additionally, the reference lists of included studies, related reviews, and books were screened to identify other potentially relevant sources. The search was not restricted by publication year but was limited to articles published in English. The final search was conducted on April 13, 2025.

Search Strategy

This systematic review and meta-analysis were conducted in accordance with the PRISMA reporting guideline (PRISMA 2020 statement). The review protocol

was prospectively registered in PROSPERO (registration number: CRD420251036604). The above five electronic databases were searched using a Boolean logic-based multi-field search strategy without restrictions on the date range. Specifically, (1) Web of Science: mental toughness (Title) AND sport* OR athlete* OR player* OR athletic* OR exercise* OR training* OR developing (All Fields); (2) PubMed: (mental toughness[Title/Abstract]) AND (sport* OR athlete* OR player* OR athletic* OR exercise* OR training* OR developing)) AND (English[Language]; (3) Scopus: TITLE (mental AND toughness) AND TITLE-ABS-KEY (sport* OR athlete* OR player* OR athletic* OR exercise* OR training* OR developing)) AND (LIMIT-TO (LANGUAGE, "English"); (4) Embase: ('mental toughness'/exp OR 'mental toughness' OR (mental AND ('toughness'/exp OR toughness))) AND 'mental toughness':ti AND (sport*:ti,ab,kw OR athlete*:ti,ab,kw OR player*:ti,ab,kw OR athletic*:ti,ab,kw OR exercise*:ti,ab,kw OR training*:ti,ab,kw OR developing:ti,ab,kw) AND [english]/lim; (5) SPORTDiscus: TI mental toughness AND (sport* OR athlete* OR player* OR athletic* OR exercise* OR training* OR developing).

Selection Process

Two reviewers were involved in the study selection process and independently screened titles and abstracts to assess their relevance. Studies that fell outside the scope of this systematic review were excluded. All eligible articles were then subjected to full-text screening, with two researchers independently evaluating the eligibility of the identified articles based on the inclusion criteria. Any disagreements between reviewers were resolved by consensus or confirmation of a third investigator.

Data Collection Process

Data extraction was conducted by one researcher using a standardized form from the full texts of eligible articles, with a second researcher verifying the accuracy and completeness of the extracted data. Discrepancies regarding the extracted data were resolved by consensus or confirmation of a third investigator.

Data Items

The authors extracted the following information from each of the included studies: (1) publication details (authors, year); (2) participant characteristics (number of participants, country, age, gender, role); (3) research design, number of experimental groups and number of participants per group; (4) intervention strategies, including training tools/techniques implemented intervention duration and frequency; (5) measurement tools and types of outcome metrics used; and (6) effect sizes.

Study Risk of Bias Assessment

To assess the reporting quality and risk of bias of the studies included in our review, two authors independently utilized a modified Downs and Black index (Downs & Black, 1998) to evaluate the studies. This method is suitable for assessing the reporting quality of both randomized and non – randomized intervention studies and is widely used in systematic reviews related to sports science (Toth et al., 2020; Thurlow et al., 2024; Kittel et al., 2025). A score of 0 was assigned for any item that lacked explicit information for accurate assessment. The study quality was evaluated by two investigators independently and any discrepancies were resolved by consensus or confirmation of a third investigator.

Effect Measures

The primary outcome of interest is self-reported and other-reported MT ratings, with MT scores translated into standardised variables to address heterogeneity in measurement tools. The intended summary effect measures are standardised mean differences (SMDs), applicable to between-subjects design. SMDs were estimated according to each study's design. The meta-analyses were implemented using RevMan 5.4 (Cochrane Collaboration, Oxford, UK) in this review for the effect size estimates. The standardized mean difference (SMD) with 95% confidence intervals (CI) was extracted from the pre- and post-intervention.

Synthesis Methods

Pooled effect sizes were estimated using a random effects model and were presented in forest plots. The heterogeneity was assessed using the I^2, with I^2 values of 25%, 50%, and 75% indicating low, medium, and high heterogeneity, respectively (Higgins & Thompson, 2002). The random-effects model assumes that each observed effect size is a random draw from a distribution of true effects, so between-study variability reflects both sampling error and genuine heterogeneity (Wang et al., 2023). Sensitivity analyses were conducted to assess the robustness of the pooled effect across study designs by comparing randomised controlled trials with quasi-experimental studies. A leave-one-out procedure was employed to determine whether any single investigation materially altered the overall estimate.

Reporting Bias Assessment

Reporting bias and small-study effects were examined via funnel-plot inspection and Egger's test (Egger et al., 1997). Asymmetry was considered present when the funnel plot showed visual distortion and the Egger intercept yielded $p < 0.10$.

Results

Study Selection

The initial search yielded 1297 studies. Following the removal of duplicates (n=465) and retraction(n=1), 831 underwent title and abstract screening, 29 articles were subject to full text review and 21 studies were excluded for not meeting the eligibility criteria. In addition, 7 relevant studies were identified through citation searching, 2 studies were included after full-text review. This process resulted in a total of 10 studies included in the review (see Figure 1).

Study Characteristics

The combined participant count across all included studies was 465, with an average sample size of 47 participants

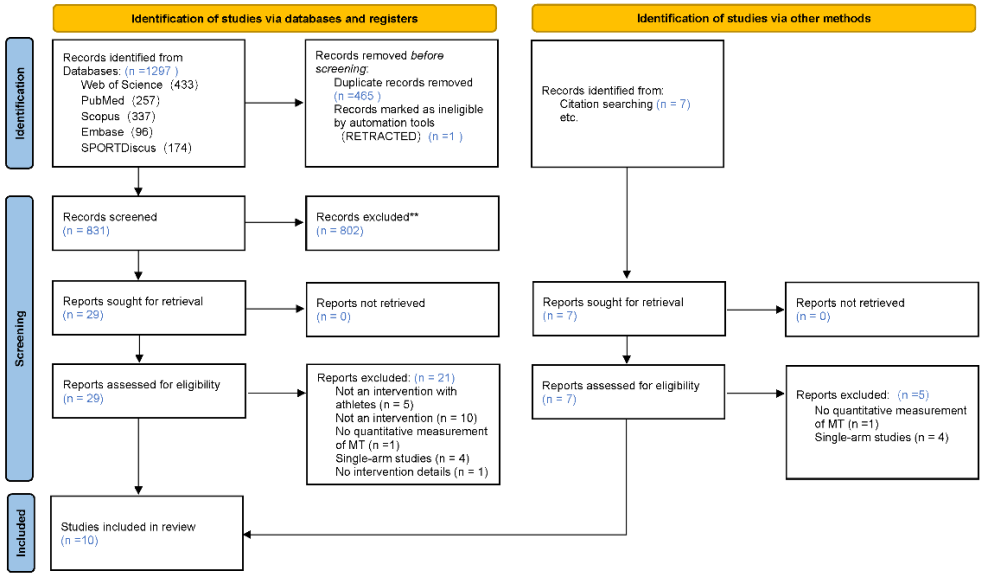

Fig. 1. PRISMA flow chart of search process

Table 1. Summary of included studies in this review.

Study	Population	Study Design	Intervention		Measures
Authors, Year	**Characters**	**Type/ Arm**	**Strategies**	**Duration /Frequency**	**Tools**
Abdelbaky, 2012	Race walking Romania Gender missing	QED EG CG	Mental Toughness Program	8 weeks, 3 days per week	PPI
Ajilchi et al., 2019	Basketball Iran male	RCT EG CG	Mindful Sport Performance Enhancement	6 weeks, 1 session(90-min) per week	MTQ48
Ajilchi et al., 2022	Type missing Iran Female	RCT EG CG	Mindfulness–Acceptance–Commitment programme	7 weeks, 1 session(45-min) per week	SMTQ
Bell et al., 2013	Cricket UK male	QED EG CG	Mental toughness training program	2 years, 5 events, 46 days in total	MTI
Bhambri et al., 2005	Table –tennis India Male & female	QED EG-COM EG-IM EG-RE CG	Imagery training; Relaxation training; Combination	2 weeks	PPI
Gucciardi et al., 2009	Football Australia male	QED EG-PST EG-MTT CG	Psychological Skills Training program	6 weeks, 1 session(120-min) per week	AfMTI
Pociusi et al., 2024	Basketball Lithuania male	QED EG CG	mental toughness skills training program	6 weeks, 1 session(60-min) per week	MTQ48
Putra et al., 2025	Type missing Indonesia Male & female	QED EG CG	MTTC model	11 weeks, 3 session(75-100-min) per week	MTI-G
Sharma et al., 2023	Table tennis India male	QED EG CG	Visual Motor Behaviour Rehearsal Training	6 weeks, 3 session(40-min) per week	SMTQ
Singh et al., 2020	Football India Gender missing	QED EG CG	Visuo Motor Behavioral Rehearsal	6 weeks, 5 session(30-min) per week	PPI

Note: RCT, Randomized Controlled Trial; QED, Quasi-experimental Design; EG, Experimental Group; CG, Control Group; COM, Combination Group; IM, Imagery Group; RE, Relaxation Group; MTT, Mental Toughness Training Group; PST, Psychological Skills Training Group; PPI, Psychological Performance Inventory; MTQ48, Mental Toughness Questionnaire (48 Items); SMTQ, The Sports Mental Toughness Questionnaire; MTI, Mental Toughness Inventory; AfMTI, Australian football Mental Toughness Inventory; MTI-G, Mental Toughness Index (Gucciardi).

per study. The studies encompassed a diverse range of sports and athletic skill levels. In terms of sports, the primary ones were football (n=24.7%), basketball (n=19.7%), and table tennis (n=17.5%), with other sports such as cricket, race walking also represented. Two studies did not specify the particular sport (n=11.1%). Regarding skill levels, three studies featured national-level athletes (n=18.8%), while others included athletes from sports academies, state-level, student-athletes, sport science students, and amateurs.

Seven studies shared the most popular intervention strategy, which was a combination of multiple psychological skill trainings (n=67.3%), including techniques like self-talk, imagery, mental rehearsal, arousal regulation, attention control, active games, relaxation, breathing, progressive muscle relaxation, and goal-setting. Mindfulness training was the focus of two studies (n=16%), and Visual Motor Behaviour was examined in two others (n=19.2%), though the main techniques were linked to psychological skill training. One study looked into the role of stressful environments with multidisciplinary team support (n=8.8%). One experimental group in a study focused on developing key mental toughness traits(7.9%), while the other experimental group used PST combination strategy.. Table 1 presents a summary of the participants and study characteristics of the included studies. For more details, please see Supplementary Information.

Risk of Bias in Studies

Table 2 summarises the outcomes of the modified Downs and Black scale for the assessment of reporting quality and risk of bias. Results ranged from 7 to 11, with a mean score of 9.5 ± 1.03.

Results of Individual Studies

Details of the training strategies and study outcomes of individual studies were provided in Table 1. Figure 2 displays the forest plot of individual-study standard mean difference (SMD) and the pooled effect estimate for MT training outcomes. The analysis is restricted to published data only.

Results of Syntheses

The estimated standardized mean differences (SMDs) ranged from 0.05 (Sharma & Prasad, 2023) to 2.30 (Ajilchi

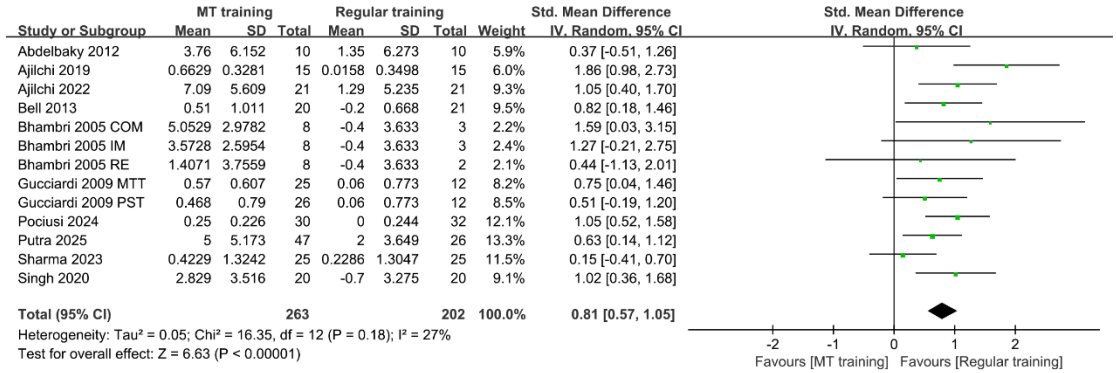

Fig. 2. Forest plot for meta-analyses. COM, Combination Group; IM, Imagery Group; RE, Relaxation Group; MTT, Mental Toughness Training Group; PST, Psychological Skills Training Group

Table 2. Modified Downs and Black scale outcomes for the assessment of reporting quality and risk of bias.

Study	Quality Assessment Domains														Total/14
	1	2	3	6	7	10	12	15	18	20	22	23	25	27	
Abdelbaky, 2012	1	1	1	1	1	1	0	0	1	1	1	1	1	0	11
Ajilchi et al., 2019	1	1	1	1	1	1	0	0	1	1	0	1	1	0	10
Ajilchi et al., 2022	1	1	1	1	1	1	0	0	1	1	0	1	1	0	10
Bell et al., 2013	1	1	1	1	1	1	0	0	1	1	0	0	1	0	9
Bhambri et al., 2005	1	1	1	1	1	1	0	0	1	1	1	0	0	0	9
Gucciardi et al., 2009	1	1	1	1	1	1	0	0	1	1	0	1	1	0	10
Pociusi et al., 2024	1	1	1	1	1	1	0	0	1	1	0	1	1	0	10
Putra et al., 2025	1	1	1	1	1	1	0	0	1	1	0	1	0	0	9
Sharma et al., 2023	1	1	1	1	1	1	0	0	1	1	1	1	0	0	10
Singh et al., 2020	1	1	1	1	1	0	0	0	1	0	1	0	0	0	7

Note: 0 = no; 1 = yes; U = unable to determine. Item 1: clear aim/hypothesis; Item 2: outcome measures clearly described; Item 3: patient characteristics clearly described; Item 6: main findings clearly described; Item 7: measures of random variability provided; Item 10: actual probability values reported; Item 12: participants prepared to participate representative of the entire population; Item 15: blinding of outcome measures; Item 18: appropriate statistics; Item 20: valid and reliable outcome measures; Item 22: participants recruited over the same period; Item 23: randomised; Item 25: adjustment made for confounding variables; Item 27: a power to detect a clinically important effect.

Table 3. Sensitivity Analyses Results

Study omitted	Estimate			Heterogeneity:		
	SMD	95% Conf. Interval	P	Q	P	I^2
ALL trials include	0.81	[0.57, 1.05]	P < 0.0001	16.35	0.18	27%
Nonrandomized controlled trials	0.79	[0.40, 1.18]	P < 0.0001	13.86	0.03	57%
Abdelbaky, 2012	0.84	[0.59, 1.08]	P < 0.0001	15.46	0.16	29%
Ajilchi et al., 2019	0.73	[0.53, 0.93]	P < 0.0001	10.33	0.50	0%
Ajilchi et al., 2022	0.78	[0.53, 1.04	P < 0.0001	15.67	0.15	30%
Bell et al., 2013	0.81	[0.55, 1.08]	P < 0.0001	16.34	0.13	33%
Bhambri et al., 2005 COM	0.79	[0.55, 1.03]	P < 0.0001	15.33	0.17	28%
Bhambri et al., 2005 IM	0.80	[0.55, 1.04]	P < 0.0001	15.94	0.14	31%
Bhambri et al., 2005 RE	0.82	[0.57, 1.07]	P < 0.0001	16.15	0.14	32%
Gucciardi et al., 2009 MTT	0.82	[0.55, 1.08]	P < 0.0001	16.34	0.13	33%
Gucciardi et al., 2009 PST	0.84	[0.58, 1.09]	P < 0.0001	15.67	0.15	30%
Pociusi et al., 2024	0.78	[0.52, 1.04]	P < 0.0001	15.30	0.17	28%
Putra et al., 2025	0.84	[0.57, 1.11]	P < 0.0001	15.89	0.15	31%
Sharma et al., 2023	0.88	[0.67, 1.09]	P < 0.0001	10.46	0.49	0%
Singh et al., 2020	0.79	[0.53, 1.05]	P < 0.0001	15.85	0.15	31%

Note: Nonrandomized controlled trials included: Bell et al., 2013, Bhambri et al., 2005 (CON, IM, RE), Putra et al., 2025, Singh et al., 2020.

et al., 2019), reflecting intervention-specific effects spanning the continuum from negligible to highly substantial. Bhambri et al. (2005) included three intervention arms—two single-strategy PST conditions (Relaxation and Imagery) and one combined-strategy condition, whereas Gucciardi et al. (2009) provided two arms consisting of a composite PST protocol and a key mental toughness traits protocol (MTT). Together, these five arms were retained in this meta-analysis to elucidate the overall efficacy of mental toughness training programmes. The pooled effect size was both statistically and practically significant, yielding a large standardized mean difference of g = 0.81 (95 % CI 0.57–1.05, p < .001), indicating a robust advantage for mental-training interventions over control conditions. The entire confidence interval(CI 0.57–1.05) lies above Cohen's threshold for a medium effect, providing compelling evidence of the efficacy of mental-training interventions. The 95 % CI's width reflects modest imprecision attributable to the limited study pool, yet its entirety lies in the large-effect range. Thus, the evidence robustly affirms the efficacy of mental-training interventions for heightening mental toughness across varied athletic populations. The heterogeneity among studies was low (Q=16.35) I^2 = 27%, p = 0.18), indicating acceptable consistency across included trials and supporting the use of a random-effects model in the meta-analysis. Sensitivity analysis was conducted by removing nonrandomized controlled trials; the remaining trials (n = 7) continued to demonstrate a statistically significant effect (g = 0.79, 95% CI 0.40–1.18, p < .001). Heterogeneity was significant and moderate (Q = 13.86, I^2 = 57%, p = 0.03). A sensitivity analysis using the leave-one-out method was conducted to examine the influence of individual studies on the overall pooled effect size and heterogeneity. Excluding the study with the highest standardized mean difference (Ajilchi et al., 2019) reduced the pooled SMD from 0.79 to 0.73 (95% CI: 0.53–0.93, p < .001), with heterogeneity decreasing from I^2 = 27% to 0%. Conversely, removing the study with the lowest effect size (Sharma & Prasad, 2023) increased the pooled SMD to 0.88 (95% CI: 0.67–1.09, p < .001), again resulting in I^2 = 0%. These changes suggest that methodological differences or potential bias in individual studies may account for the observed heterogeneity. However, across all iterations of the leave-one-out procedure in Table 3, the pooled effect estimates remained within a narrow range (0.73–0.88), indicating that no single study unduly influenced the overall findings. This supports the robustness and reliability of the meta-analytic results.

Reporting Biases

As shown in Figure 3, the funnel plot appears visually symmetrical, with an approximately equal distribution of studies on both sides of the mean effect size. Given the inclusion of only 10 studies, it is difficult to reliably detect

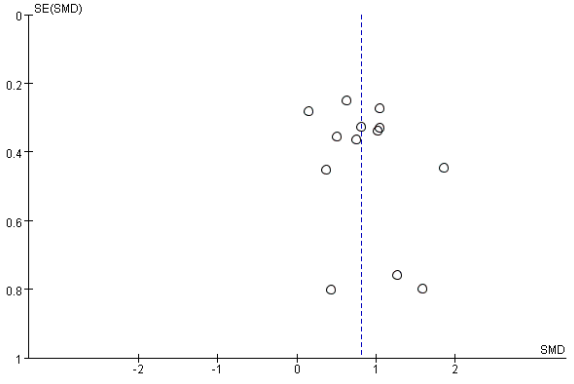

Fig. 3. Funnel plot

deviations from the ideal distribution. Furthermore, Egger's regression test yielded a bias coefficient of 1.05 (SE = 1.01, t = 1.04, p = 0.321), indicating no statistically significant asymmetry in the funnel plot. Therefore, there is no evidence of publication bias in this analysis.

Discussion

Compared to previously published narrative and systematic reviews, the present study provides more empirical support for the development of mental toughness by strictly limiting the inclusion criteria to quantitative controlled experimental studies. This meta-analysis synthesized evidence from 10 studies, demonstrating that interventions aimed at enhancing mental toughness are significantly effective across various sporting contexts and levels of competition. Despite differences in sample characteristics, intervention modalities, and types of sport, the low level of between-study heterogeneity suggests a high degree of robustness in the overall findings. Sensitivity analyses further reinforced this conclusion, indicating that while differences in study design or methodological quality may account for some heterogeneity, no single study disproportionately influenced the overall effect size.

Mental toughness can be developed through various approaches (Bull et al., 2005), yet no research has determined the superiority of any single method (Clough & Strycharczyk, 2012). Although this meta-analysis integrated the effects of diverse interventions, it remains difficult to identify a single best strategy for cultivating mental toughness due to differences in study designs, intervention components, and participant populations. Psychological skills training (PST) is widely regarded as one of the most commonly used programs for fostering positive psychological development (Park & Jeon, 2023; Williams & Krane, 2001). Most of the included studies (n = 7) adopted multi-component PST strategies – such as goal setting, imagery, self-talk, arousal regulation, relaxation, and attentional control. Bhambri et al. (2005), for instance, empirically suggested that combined strategies may be more effective than single techniques. However, due to the wide variability in intervention efficacy and the presence of potential bias in some studies (e.g., non-randomized quasi-experiments), the actual effectiveness and applicability of the interventions reported in the included studies should be viewed with caution. More rigorous empirical research will help identify intervention strategies that should be prioritized for improving athletes' Mental toughness.

Although this review strictly followed the PRISMA reporting guidelines, this systematic review and meta-analysis also have some limitations. First, the total number of included studies (n = 10) limits the generalizability and power of the analyses. Although publication bias was not detected using Egger's regression test (bias = 1.05, p = .321), the small number of included studies limits the sensitivity of funnel plot-based diagnostics. Second, intervention heterogeneity and varied measurements of MT may have introduced unaccounted biases. Third, the sustainability of outcomes remains uncertain, as the enduring impacts of these interventions cannot be ascertained without longer-term assessment. A final notable consideration is that the meta-analytic findings, derived from a synthesis of RCTs and quasi-experimental studies, are constrained by the limited number of RCTs, thereby affecting the certainty of the evidence.

The findings of this study offer clear practical value for sport psychologists, coaches, and practitioners. Implementing structured Psychological Skills Training (PST) programs – particularly those using multicomponent strategies –can significantly enhance athletes' Mental Toughness (MT). PST is a process closely tied to daily activities and skill development in sport and exercise contexts (Weinberg & Gould, 2023). Beyond the studies included in this review, numerous other investigations have explored the effects of specific PST techniques or their combinations on MT in particular settings. While the methodological rigor and quality of these studies warrant cautious interpretation, they nonetheless provide broader perspectives and valuable reference points. Therefore, when attempting to develop a mental toughness training program tailored to specific needs, it is essential to carefully select PST techniques and strategies based on factors such as sport type and population characteristics.

Future research should prioritize larger-scale RCTs with consistent intervention protocols and standardized MT outcome measures. Longitudinal designs assessing retention of MT gains post-intervention would address current gaps. Further, dismantling studies comparing single versus multicomponent strategies could clarify which techniques yield the greatest impact. Exploration of mediators and moderators, such as motivation, coping style, and sport type, would provide deeper theoretical and practical insights into how and for whom PST is most effective.

Conclusions

This meta-analysis provides strong empirical evidence supporting the effectiveness of psychological interventions—particularly multicomponent Psychological Skills Training (PST) —in enhancing mental toughness among athletes across different sports. However, due to the lack of long-term follow-up assessments, reliance on quasi-experimental designs, and diversity in measurement approaches, the findings should be interpreted with caution. To advance the field, future research should adopt more rigorous methodologies, including large-scale randomized controlled trials and longitudinal designs, to identify the most effective components and delivery methods for developing mental toughness. These efforts will ultimately inform evidence-based practices for coaches, psychologists, and practitioners aiming to cultivate high-performing athletes.

Acknowledgment

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Conflict of Interest

The authors declare that there is no conflict of interest.

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Ефективність тренування психічної стійкості у спортсменів: Систематичний огляд та метааналіз

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 12 с., 3 табл., 3 рис., 39 джерел.

Мета дослідження. Мета цього дослідження полягала у вивченні ефективності інтервенцій, спрямованих на розвиток психічної стійкості (ПС) у спорті.

Матеріали та методи. Критерії прийнятності охоплювали кількісні контрольовані експериментальні дослідження інтервенцій з розвитку ПС у спортсменів. До інформаційних джерел належали дослідження, індексовані в Web of Science, PubMed, Scopus, Embase та SPORTDiscus з моменту створення до 13 квітня 2025 року. Також проведено аналіз списків використаних джерел включених досліджень. Ризик упередженості розглядали у такий спосіб: Двоє авторів незалежно оцінили якість звітності та ризик упередженості включених досліджень, використовуючи модифікований індекс Даунса і Блека. Щодо узагальнення результатів, з метою оцінки впливу інтервенцій із використанням моделі випадкового ефекту було розраховано стандартизовану середню різницю (ССР).

Результати. Представлений огляд включав загалом 10 досліджень за участю 465 учасників, які займалися переважно футболом (24.7%), баскетболом (19.7%) та настільним тенісом (17.5%). У семи дослідженнях (67.3%) застосовано комбінацію інтервенцій із тренування психологічних навичок. Метааналіз охоплював усі 10 досліджень та відповідні експериментальні групи з метою з'ясування загальної ефективності програм із тренування ПС. Сукупний розмір ефекту був статистично та практично значущим, надаючи велику стандартизовану середню різницю g = 0.81 (95% ДІ 0.57–1.05, $p < 0.001$), що вказує на істотну перевагу інтервенцій із тренування ПС над контрольними умовами.

Висновки. Цей метааналіз надає переконливі емпіричні докази ефективності психологічних інтервенцій, зокрема багатокомпонентного тренування психологічних навичок (ТПН), у підвищенні психічної стійкості серед спортсменів різних видів спорту. Однак через відсутність довгострокових обсерваційних оцінок, використання квазіекспериментальних моделей та різноманітність підходів до вимірювання, слід з обережністю інтерпретувати отримані результати. Задля досягнення прогресу в цій галузі у подальших дослідженнях слід застосовувати ретельніші методології, включаючи

великомасштабні рандомізовані контрольовані випробування та лонгітюдні проєкти, щоб визначити найефективніші компоненти та методи щодо реалізації розвитку психічної стійкості. Зазначені дослідницькі зусилля в кінцевому підсумку слугуватимуть основою для науково обґрунтованих практик тренерів, психологів та фахівців-практиків, які прагнуть виховати спортсменів високого рівня.

Ключові слова: психічна стійкість, тренування психологічних навичок, спортсмени, інтервенція.

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