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REVIEW ARTICLE

The Relationship between Mental Toughness and Anxiety in Athletes: A Meta-Analysis Study

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ABSTRACTS

Purpose This study was motivated by the importance of the role of psychological aspects, especially mental toughness, in supporting athletes' abilities when facing anxiety in a match.

Materials and Methods This study used a meta-analysis method. The search used the Publish and Publish application, with Google Scholar as the database. Literature searches from various sources used the keywords: "Mental Toughness", "Athlete Anxiety", "Competitive Anxiety", "Performance Anxiety", and "Sports Psychology". Five hundred eighteen articles were obtained, which were then filtered based on inclusion and exclusion criteria, and 23 articles were analyzed.

Result The results of the analysis show a negative relationship in the moderate category between mental toughness and competitive anxiety, with rRE = -0.320 ($z = -3.030$; $p < 0.002$; 95% CI: -0.113 to -0.528). Egger's test showed no publication bias ($p = 0.748 > 0.05$).

Conclusion These findings suggest that increased mental toughness is negatively associated with athletes' levels of competitive anxiety. In other words, the higher an athlete's level of mental toughness, the lower their anåxiety levels during competition. This research suggests that coaches and sports psychologists are crucial to integrating psychological practices, such as goal setting, positive self-talk, and imagery, into athletes' training programs. This approach can help improve mental toughness and reduce athletes' anxiety during competition.

Keywords Mental toughness; Anxiety; Athletes; Sports psychology.

INTRODUCTION

Athletes consistently strive for victory, as winning not only represents achievement but also reflects identity and personal capability. To reach optimal performance, athletes intensify their training to enhance physical abilities and strengthen themselves across various domains (Islam et

al., 2025; Putra et al., 2024). Although physical fitness is essential in competitive sports, psychological readiness is equally critical and cannot be separated from athletic performance (Daley et al., 2021; Nubatonis et al., 2024; Sheean et al., 2023). In practice, however, many athletes and coaches predominantly prioritize physical conditioning and technical skills, while psychological aspects—particularly competitive anxiety—are often overlooked (Firmansyah et al., 2024; Ramesberger, 2022). This gap is concerning, as competitive anxiety has been shown to negatively affect athletes' physical condition, mental focus, and emotional stability during high-pressure competition environments (L. Yang et al., 2024). The inability to regulate anxiety before competition may prevent athletes from performing optimally, disrupting concentration, reducing emotional control, and ultimately hindering peak performance (Mojtahedi et al., 2023; Clark et al., 2022; Houwer et al., 2017).

Developments in sports psychology over the past decade have significantly deepened the understanding of factors that influence athlete performance, emphasizing the roles of mental skills, intrapersonal characteristics, and psychological readiness (Beauchamp et al., 2023). Pramesti et al. (2022) report that psychological factors contribute up to 90% of athletic success, while physiological factors contribute only 10%, highlighting the crucial need to balance physical and mental preparation. Within this psychological domain, mental toughness has emerged as a key construct for explaining how athletes cope with pressure, manage stress, and maintain performance during competition (Kawabata et al., 2021; Rintaugu et al., 2022). Mental toughness is frequently associated with adaptive functioning under stress, whereas competitive anxiety represents a maladaptive response that can undermine performance (Hudaniah & Masturah, 2024; Rocha & Osorio, 2018). Research on both variables continues to expand, including studies linking mental toughness with athletic performance (Hsieh et al., 2024), the effectiveness of mental-skills training programs (Stamatis et al., 2020; Corrêa et al., 2023; Cowden et al., 2020), and the relationship between mental toughness and other psychological constructs such as sleep quality, resilience, and personality traits (Arora et al., 2022; Liang et al., 2024).

Despite this growing body of literature, systematic evidence regarding the relationship between mental toughness and competitive anxiety across different sports disciplines remains limited. Existing studies often vary in sample characteristics, measurement tools, competitive levels, sport types, and research contexts, resulting in inconsistent effect sizes across findings (Algani et al., 2018; Armadi et al., 2023; Annisa & Kurniawan, 2022; Listiana et al., 2024). This inconsistency suggests the need for an integrative quantitative synthesis. Moreover, understanding the mechanisms by which mental toughness may buffer anxiety through enhanced stress appraisal, improved coping strategies, and enhanced attentional control (Doron & Martinent, 2021; Santos-Rosa et al., 2022) provides strong theoretical justification for conducting a meta-analysis. Therefore, the present study aims to provide a comprehensive and structured overview of the relationship between mental toughness and competitive anxiety among athletes through a meta-analytic approach, offering updated evidence and addressing inconsistencies in previous research.

METHODS

The method used in this study was meta-analysis. Meta-analysis is a statistical analysis technique used to summarize the results of multiple studies, yielding findings that integrate the most recent evidence. Meta-analysis plays a crucial role in research as an evaluation method for previous studies addressing similar themes, but data validity has not yet been fully verified (Reinebo et al., 2024). In this analysis, the effect size value is used as a parameter to determine the significance of

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the research results (Husein et al., 2025). Effect size can be expressed in raw form or as a standardized r value, representing the correlation and average difference between the two analyzed variables (Cohen, 2013).

Search Procedure

The search strategy in this study was systematically designed to identify relevant studies on the contribution of mental toughness to athletes' anxiety during competition. The literature search was conducted through various sources using the keywords: "Mental Toughness", "Athlete Anxiety", "Competitive Anxiety", "Performance Anxiety", and "Sports Psychology". Boolean operators (AND, OR) were used to combine these keywords to broaden the scope and increase the relevance of the literature obtained. Study selection was done by extracting all references into an Excel database to manage and eliminate duplicate articles. Next, the researchers reviewed the abstracts of each article found through the search strategy to identify studies that met the criteria, particularly those discussing the relationship between mental toughness and athletes' anxiety during competition.

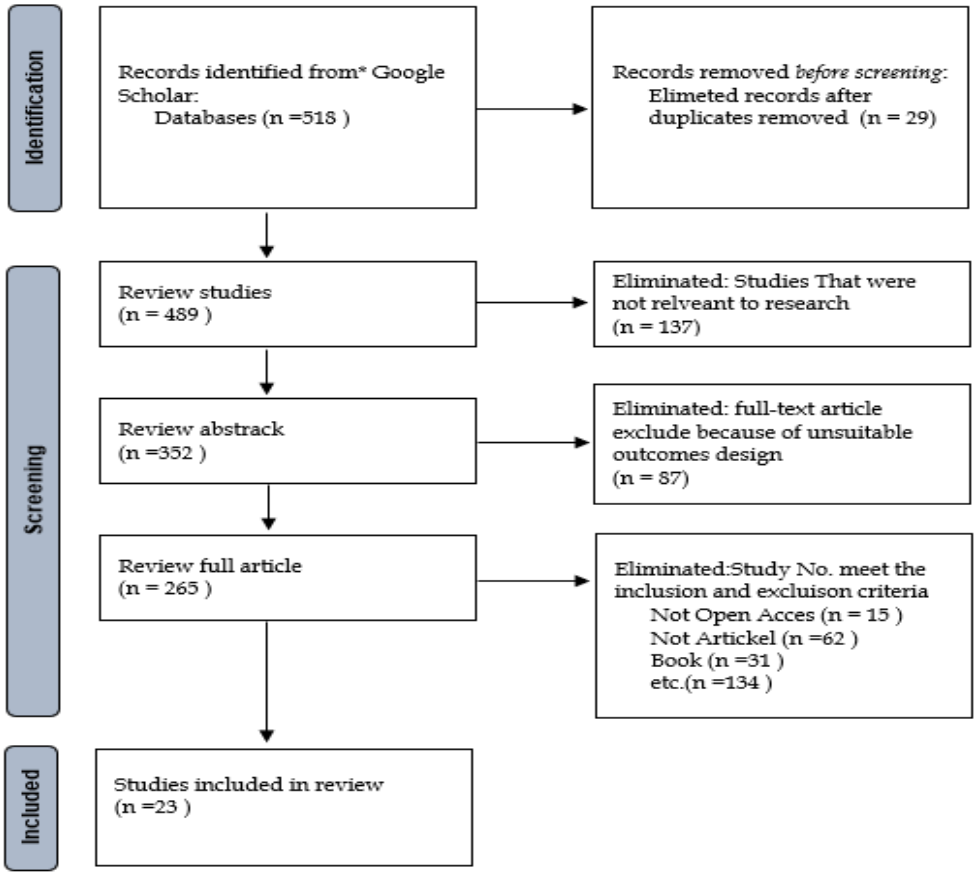

Figure 1. A flowchart is used to identify the case study data eligible for meta-analysis

Criteria Exclusion and Inclusion

In searching for and selecting articles, this study used the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach as a guide to develop a transparent, structured process for data identification, screening, and inclusion (Page et al., 2021). The PRISMA process begins with identifying articles through online databases such as Google Scholar. This meta-analysis established systematic inclusion and exclusion criteria to ensure only relevant, high-quality articles were analyzed. The inclusion criteria included quantitative studies that explicitly

examined the relationship between mental toughness and anxiety in athletes. Selected studies had to involve active athletes, both professional and amateur, from various sports.

Furthermore, only studies that used standardized, psychometrically validated instruments were included. Articles published between 2017 and 2024 in English or Indonesian and providing sufficient statistical data for effect size calculations met the inclusion criteria. Conversely, exclusion criteria included articles that were not empirical research, such as editorials, opinion pieces, or non-systematic literature reviews. Studies that did not involve an athlete population or did not directly examine the relationship between mental toughness and competition anxiety were also excluded from the analysis. Studies that used invalid measurement tools or did not report sufficient quantitative data were also excluded. Additionally, duplicate articles from the same study and those with inaccessible or unconfirmed data were eliminated.

Study Quality Assessment

After the identification and selection process based on inclusion and exclusion criteria, the articles that were obtained were evaluated for methodological quality using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies developed by The Joanna Briggs Institute (2017). This instrument is used to assess the internal validity of each study. This instrument assesses the internal validity of each study included in the meta-analysis, specifically the clarity of objectives, reliability of measurement instruments, appropriateness of statistical analysis, and control of potential biases in cross-sectional studies (Jun et al., 2021).

Statistical Analysis

The obtained data will then undergo a series of systematic analysis stages: identifying research variables by entering them into the appropriate columns and identifying correlation values in each article to be analyzed. If an article presents only specific values, those values must be converted using a predetermined formula.

Conversion dance F value to t value:

$F = t^2$

Conversion from t to r:

$$\frac{r}{\sqrt{t^2 + df}}$$

A risk of bias analysis was conducted to determine the effect size (Z) and its standard error (SEz), which were then analyzed in JASP. The effect size and standard error of effect size were calculated using the following formula:

Calculating Fisher's Z from the coefficient of correlation (ES):

$Z = 0{,}5\ xIn\ \frac{1+r}{1-r}$

Count Fisher's Z variance:

$V_2 = \frac{1}{n-3}$

Calculating Standard Error (SE):

$SE_2 = \sqrt{V_z}$

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Hypothesis Testing

Data from the effect size test results were analyzed using JASP software to obtain information regarding the presence or absence of publication bias. Publication results related to the relationship between the contribution of mental toughness and athlete anxiety during competition were categorized based on the effect size value, namely: r = 0.1 (low), r = 0.3 (moderate), and r = 0.5 (high) (Cohen, 2013; Perwira Negara et al., 2021). The research findings are presented in narrative form. Information regarding the study sample, effect size, standard error of effect size, heterogeneity test, and publication bias test is presented in tabular form. The meta-analysis in this study was conducted by calculating heterogeneity using a random-effects model to estimate the average effect size across variables that influence athlete anxiety. The publication bias test was conducted using the forest plot output, which illustrates the extent of mental toughness's contribution to athlete anxiety during competition according to the previously mentioned effect size categories. The Egger test, with a p-value greater than 0.05, further confirms the absence of publication bias in this study. This meta-analysis used JASP software, with effect size measurements calculated as standardized mean differences (Islam et al., 2025).

RESULT

Table 1. JBI checklist for cross-sectional study

Authors	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	TS
Mahendra & Novita (2025)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Ramadhan, (2025)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Ratu et al., (2025)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Ramadhina et al. (2024)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Listiana et al., (2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
Nurcahyadi & Trihandayani, (2024)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Hudaniah & Masturah, (2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
Khoirunisa et al. (2024)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Sofyan et al. (2024)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Ningsih & Rinaldi (2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Zafira & Candra (2024)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Armadi et al., (2023)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Insan, (2023)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Annisa & Kurniawan, (2022)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Susanto, (2021)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Nissa &	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10

Authors	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	TS
Soenyoto (2021)												
Noviansyah & Jannah, (2021)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Retnoningsasy & Jannah, (2020)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Darisman et al., (2020)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Ikhram et al., (2020)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Nugraha et al. (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
Algani et al. (2018)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Raynadi et al., (2017)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9

Question 1 examined whether the two groups were similar and recruited from the same population, while Question 2 assessed whether exposures were measured comparably between the exposed and unexposed groups. Question 3 evaluated whether the exposure was measured validly and reliably. Question 4 focused on whether confounding factors were identified, and Question 5 considered whether strategies to address these confounders were stated. Question 6 determined whether participants were free of the outcome at the start of the study or at the moment of exposure. Question 7 assessed whether the outcomes were measured validly and reliably. Question 8 examined whether the follow-up period was reported and sufficiently long for the outcomes to occur. Question 9 considered whether follow-up was complete and whether reasons for loss to follow-up were described and explored. Question 10 evaluated whether strategies to address incomplete follow-up were utilized. Finally, Question 11 assessed whether an appropriate statistical analysis was used.

Based on keywords entered into Google Scholar, 518 articles discussed mental toughness and athlete anxiety. After screening for inclusion and exclusion criteria, 23 articles were deemed suitable for analysis. The studies selected for analysis are presented in Table 2 below.

Table 2. Results of the Data Study to be Meta-Analyzed

No.	Author	Sampel	N	Result			SE	ES
				F	T	R		
1	Mahendra & Novita (2025)	Martial arts	60			-0.731	-0.931	0.132
2	Ramadhan, (2025)	Futsal	150			0.175	0.177	0.082
3	Ratu et al (2025)	Karate	227			-0.527	-0.586	0.067
4	Ramadhina et al (2024).	Softball	34			-0.720	-0.908	0.180
5	Listiana et al (2024)	Mixture	151		-4.558	-0.030	-0.030	0.082
6	Nurcahyadi & Trihandayani (2024).	Rafting	35			-0.480	-0.523	0.177
7	Hudaniah & Masturah, (2024)	Self-defense	239			-0.726	-0.920	0.065
8	Khoirunisa et al (2024).	Volleyball	62			-0.292	-0.301	0.130
9	Sofyan et al (2024).	Diving	24			-0.415	-0.442	0.218
10	Ningsih & Rinaldi (2024).	Athlete	109			0.379	0.399	0.097
11	Zafira & Candra (2024).	Badminton	11			-0.474	-0.515	0.354
12	Armadi et al (2023)	Volleyball	160		7.085	0.044	0.044	0.080
13	Insan, (2023)	Futsal	80		3.501	0.044	0.044	0.114
14	Annisa & Kurniawan, (2022)	Basketball	54			-0.586	-0.672	0.140

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No.	Author	Sampel	N	Result			SE	ES
				F	T	R		
15	Susanto, (2021)	Self-defense	30			-0.369	-0.387	0.192
16	Nissa & Soenyoto (2021).	Self-defense	84			-0.480	-0.523	0.111
17	Noviansyah & Jannah, (2021)	Self-defense	60			0.105	0.105	0.132
18	Retnoningsasy & Jannah, (2020)	Badminton	100			-0.506	-0.557	0.102
19	Darisman et al (2020)	Softball	49			-0.670	-0.811	0.147
20	Ikhram et al (2020)	Karate	53			0.729	0.927	0.141
21	Nugraha et al (2020).	Mixture	175			0.365	0.383	0.076
22	Algani et al (2018).	Volleyball	118			-0.670	-0.811	0.093
23	Raynadi et al (2017)	martial arts	30			-0.614	-0.715	0.192

Table 2 summarizes 23 studies analyzed in the meta-analysis with sample sizes ranging from 11 to 239 participants across various sports. The effect size values show both positive and negative directions, indicating variability in the relationship between mental toughness and athlete anxiety. Most studies display negative effect sizes, suggesting an overall tendency that higher mental toughness is associated with lower anxiety levels. The standard error values range from 0.065 to 0.354, indicating adequate precision across studies.

Heterogeneity Test

Table 3. Fixed and Random Effects

	Q_e	Df	P
Omnibus test of Model Coefficients	9.181	1	0.002
Test of Residual Heterogeneity	500.002	22	< .001

According to the analytical outcomes presented in Table 3, which employ fixed- and random-effects models, the 23 effect sizes derived from the examined studies exhibit considerable heterogeneity ($Q = 500.002$; $p = 0.01 < 0.05$). Therefore, the random-effect model is more appropriate for estimating the average effect size across the 23 analyzed studies. The findings of this analysis indicate that it is possible to analyze moderating factors that influence athlete anxiety during competition.

Table 4. Residual Heterogeneity Estimates

		95% Confidence Interval	
	Estimate	Lower	Upper
τ^2	0.237	0.133	0.480
T	0.487	0.364	0.693
I^2 (%)	95.327	91.952	97.641
H^2	21.402	12.426	42.383

According to the analytical findings in Table 4, the Residual Heterogeneity Estimates reveal a significant correlation between mental toughness and athlete anxiety during competitive events, as evidenced by a pronounced level of heterogeneity across the studies examined. The I^2 statistic of 95.327% (95% CI: 91.952–97.641) suggests that nearly 95% of the observed variability in effect sizes is attributable to intrinsic differences among studies rather than sampling error. This finding corroborates the proposition that additional variables may be influencing the interaction between mental toughness and competitive anxiety. Furthermore, the τ^2 value of 0.237 and the τ value of 0.487 indicate genuine variance among the studies included in this meta-analytic assessment. In

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addition, the H^2 value of 21.402 signifies that the aggregate variability observed within the studies is approximately 21 times greater than expected in the absence of heterogeneity.

Hypothesis Test

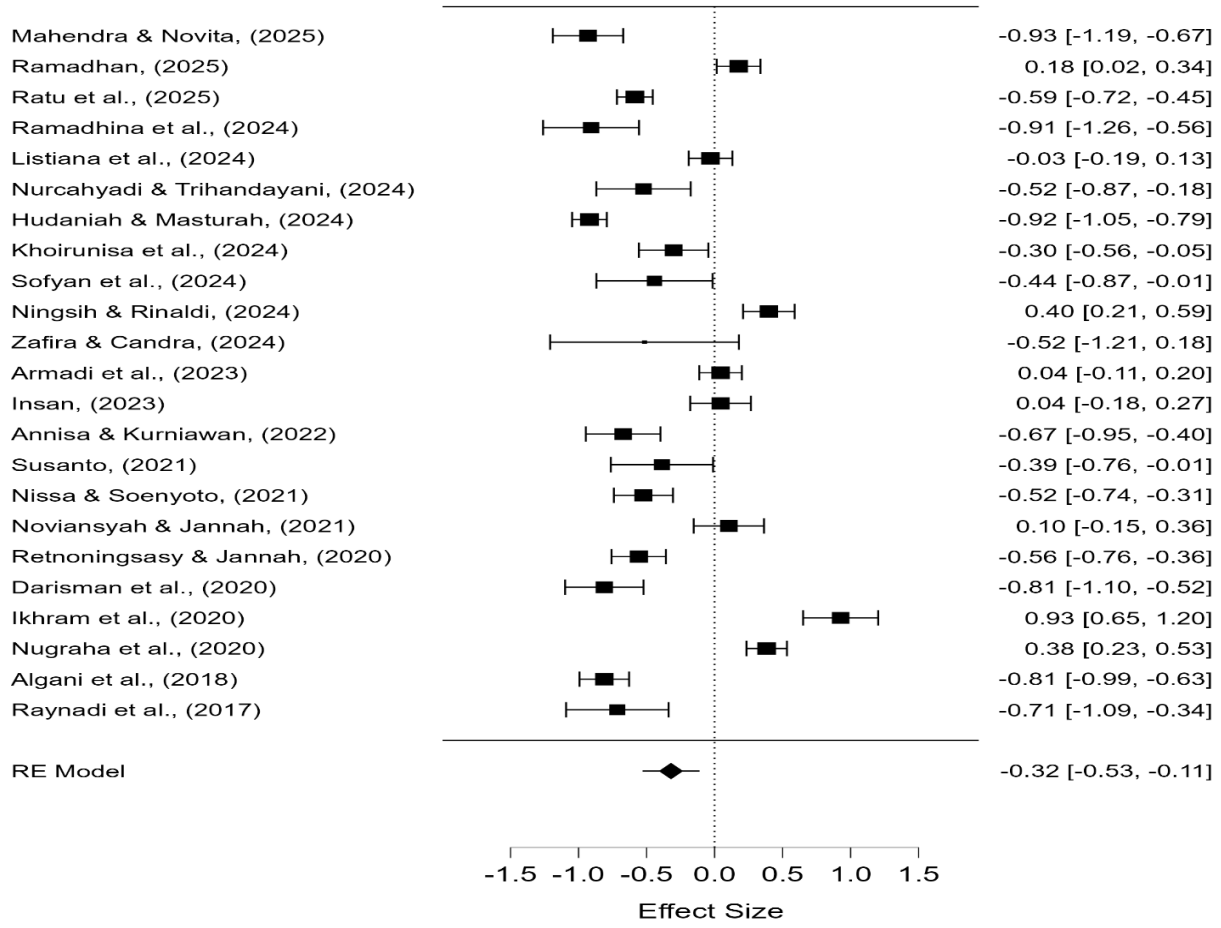

Figure 2. Forest Plot

Figure 2 shows a forest plot of effect sizes from 20 included studies. The majority of studies demonstrated negative effect sizes, while a few showed positive effects. The pooled effect using the random-effects model was −0.32 [95% CI: −0.53, −0.11], indicating a statistically significant overall effect because the confidence interval does not cross zero. This suggests that, collectively, the intervention has a small but meaningful effect.

Table 5. Effect measuring model test

95% Confidence Interval						
Estimate		Standard Error	Z	P	Lower	Upper
Intercept	-0.320	0.106	-3.030	< .002	-0.113	-0.528

According to the analytical findings presented in Table 5, using a random-effects model, a statistically significant inverse correlation has been identified between mental toughness and athlete anxiety in competitive settings ($z = -3.030$, $p < 0.002$, 95% CI: -0.113; -0.528). The effect size for the relationship between mental toughness and athlete anxiety during competition falls within the moderate range ($rRE = -0.320$).

Publication Bias Test

The investigation of publication bias was undertaken to evaluate whether the published data utilized in this research accurately reflect the broader population. Publication bias can be detected by analyzing the values obtained from Rank Correlation and Regression analyses. The Egger test is subsequently used when the funnel diagram fails to exhibit symmetry. This assessment ascertains the symmetry of the funnel plot by analyzing the derived p-value. Should the p-value exceed the 0.05 significance threshold, one may infer that the funnel plot is symmetrical, suggesting the absence of publication bias.

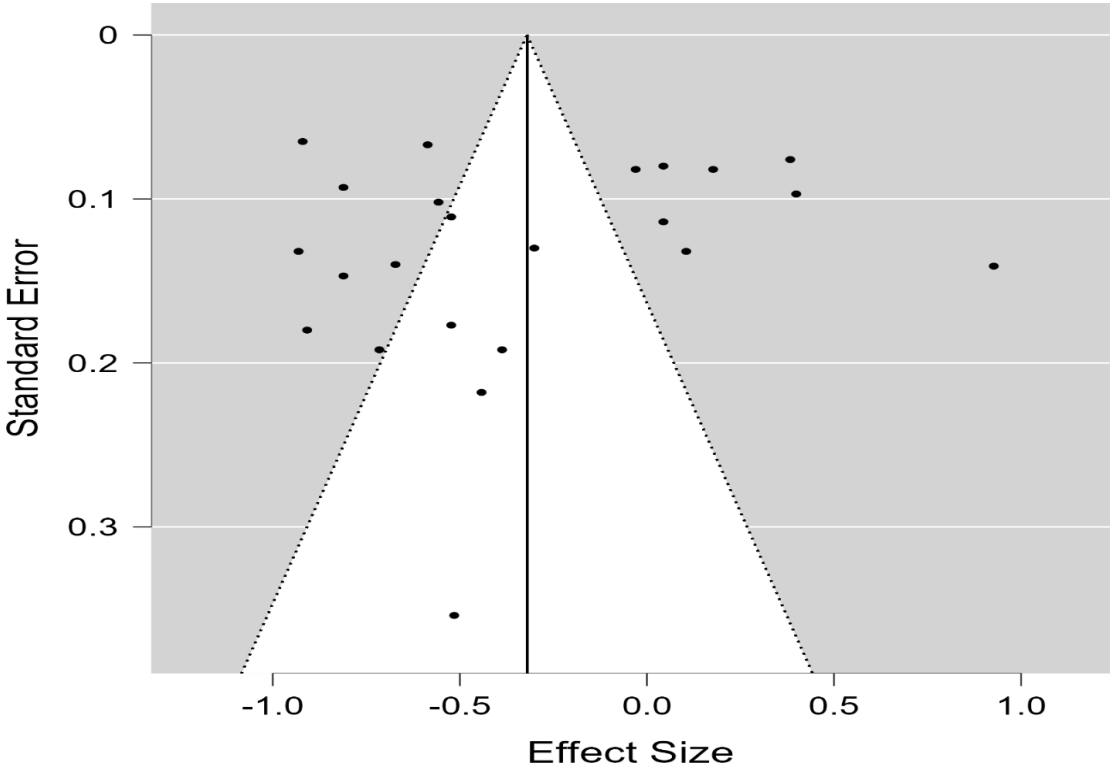

Figure 3. Forest plot

The analysis in Figure 3 shows the results of a regression test on the funnel diagram, which indicates an imbalance in the data distribution and provides no firm evidence of symmetry. Therefore, further analysis using Egger's test is needed to assess symmetry and confirm the validity of the findings regarding potential publication bias. The results of Egger's test analysis, which provide a more in-depth overview of this possible bias, are presented in Table 5 below.

Table 6. Regression Test for Funnel Plot Asymmetry ("Egger's test")

	Z	P
Sei	321	0.748

Based on the Egger test analysis in Table 6, a p-value > 0.05 indicates that the funnel plot is symmetrical. Thus, there is no publication bias in this meta-analysis study.

Table 7. Record Drawer Test

	Fail-safe N	Target Significance	Observed Significance
Rosenthal	1284.000	0.050	< .001

Based on the analysis results of Table 7 of the Record Drawer Test, to estimate the number of articles with insignificant results that have not been published (Husein et al., 2025). Based on the Record Drawer Test results on a meta-analysis with k = 23 studies, a Fail-safe N = 1,284 was obtained at a significance target of 0.05 (observed $p < 0.001$). This value greatly exceeds the Rosenthal rule-of-thumb threshold of 5k + 10 = 125, approximately 10.27 times (1.284/125). This means that approximately 1.284 "missing" studies with zero effect are needed to render the combined results insignificant; thus, the meta-analysis conclusion is robust against potential publication bias. Equivalently, the magnitude of the implied combined test is also powerful (≈ Zmeta 14.78, two-tailed), in line with $p < 0.001$. The results of the study indicate that the meta-analysis is robust against publication bias, as a large number of studies with zero effect sizes is needed to negate the significance of the results. Thus, the meta-analysis findings can be considered stable, reliable, and not easily influenced by the potential presence of unpublished studies.

DISCUSSION

The present synthesis demonstrates that athletes with stronger mental toughness consistently exhibit lower levels of competitive anxiety across various sporting contexts. This pattern reinforces earlier work showing that mental toughness contributes to composure, confidence, and emotional control in high-pressure situations (Cowden et al., 2020; Aryanto & Larasati, 2020). Prior research has similarly emphasized that mental toughness is essential for achieving optimal performance, functioning as a psychological stabilizer that helps athletes regulate stress responses in demanding environments (Liew et al., 2019). Foundational studies also describe mental toughness as a quality shaped over time through accumulated competitive experiences, which strengthens athletes' capacity for self-regulation and focus under pressure (Connaughton et al., 2008; Kumbar & Patil, 2024). In line with these perspectives, the present findings position mental toughness as a core psychological buffer that minimizes the disruptive impact of competitive anxiety, underscoring its central role in supporting stable emotional functioning during competition.

Further examination suggests that mental toughness exerts its influence through interconnected cognitive and emotional processes that unfold throughout competition. Athletes with stronger psychological resilience typically appraise stressful situations as challenges, which shapes their emotional responses and action strategies in adaptive ways (Doron & Martinent, 2021). These athletes also benefit from psychological training environments that build consistent habits of attentional control, constructive self-evaluation, and emotional recovery (Corrêa et al., 2023). Their readiness is supported by the capacity to manage uncertainty, recalibrate focus after errors, and respond to situational demands with composure. Motivational and perceptual systems also contribute to this process, as athletes' self-beliefs and interpretations of competitive cues determine how physiological tension is experienced and regulated. This combination of experience-based learning, emotional readiness, and stable self-confidence creates a psychological profile that is inherently more resistant to anxiety intensification during competition (Broa & Baradillo, 2024).

The meaning of these findings becomes stronger when considering how psychological responses vary across different sports and athlete characteristics. Individual sports—such as athletics, swimming, or combat sports—tend to produce higher levels of anticipatory stress because the responsibility for performance rests entirely on the individual, heightening vulnerability to competitive anxiety (Kemala & Mamesah, 2020; Moroianu & Popescu, 2023; Zhou et al., 2024). In such contexts, mental toughness becomes especially critical in stabilizing emotional

responses. Conversely, team sports offer shared responsibility and greater social buffering, which can reduce the overall emotional burden on individual athletes (Hsieh et al., 2024). Gender differences have also been noted, with female athletes more often reporting heightened competitive anxiety despite similar levels of mental toughness, potentially reflecting sociocultural expectations or differing emotional socialization patterns (Ponseti Verdaguer et al., 2017; Rocha & Osorio, 2018). Competitive experience further shapes these dynamics; athletes with extensive exposure to high-pressure environments typically exhibit more mature coping strategies and more efficient emotional regulation, allowing mental toughness to function as a stronger protective factor (Vasconcelos-Raposo et al., 2024). These patterns illustrate that the meaning of mental toughness cannot be separated from the context in which it functions.

This synthesis contributes to the theoretical understanding of mental toughness by consolidating findings across diverse athlete groups and highlighting previously inconsistent results. Some earlier literature reported weak or nonsignificant relationships between mental toughness and anxiety, often in high-arousal sporting environments or settings with distinct cultural interpretations of emotional expression (Guszkowska & Wójcik, 2021). The current analysis clarifies these discrepancies by demonstrating that contextual moderators such as sport characteristics, cultural settings, and athlete experience play pivotal roles in shaping emotional outcomes. Furthermore, the findings strengthen applied perspectives suggesting that psychological strategies such as goal setting, self-talk, and mental imagery can be practical tools for cultivating mental toughness when tailored to athletes' needs (Jeong et al., 2023; Santos-Rosa et al., 2022; Simonsmeier et al., 2021). These represent a meaningful expansion of existing literature, offering a more integrated framework that links developmental processes, emotional regulation, and situational pressures.

Several limitations warrant consideration. Most of the included studies originated from national journals, which may limit the generalizability of the findings to broader international sporting contexts. Sample sizes varied considerably across studies, raising the possibility that some associations may be influenced by statistical instability. Instruments for assessing both mental toughness and competitive anxiety were not fully standardized, which may introduce variability related to conceptual or measurement differences. Cultural variations in sport environments may also significantly shape athletes' psychological responses (Rahayuni, 2019). These limitations suggest that, while the findings are meaningful, broader, more methodologically consistent evidence remains necessary.

Future research should incorporate more diverse international samples, standardized measurement tools, and explicit moderator analyses covering sport type, gender, competitive experience, and cultural background. Longitudinal and experimental research designs could provide stronger insight into how mental toughness develops and how it interacts with anxiety over time. From an applied standpoint, integrating psychological skills training into regular practice routines remains a promising direction, particularly when interventions are aligned with athletes' developmental stages and sport-specific demands (Purcell et al., 2022; Reardon et al., 2024). By combining tailored interventions with more profound theoretical clarity, future studies can further refine how mental toughness is cultivated and how it contributes to emotional readiness and performance stability in competitive sport.

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CONCLUSION

There is a moderate relationship between mental toughness and anxiety in athletes, with a negative correlation, meaning that the higher the mental toughness, the lower the level of anxiety experienced by athletes. This study has several limitations. First, the reference sources were only from national (Indonesian) journals, so the theoretical and empirical scope is limited. Second, several of the studies analyzed used small sample sizes, which may affect the generalizability of the findings. Third, differences in the anxiety measurement instruments used across studies could affect the consistency of the results. Fourth, cultural differences between regions may also influence the findings in this study. Therefore, further research is recommended to conduct analyses by specific sport and to identify factors that influence the relationship between mental toughness and anxiety in athletes, such as competitive experience level, athlete status (amateur or professional), gender, and sample size.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this matter.

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