Psychological analysis of anxiety and its impact on athletic performance in competitive sports

Análisis psicológico de la ansiedad y su impacto en el rendimiento deportivo en deportes competitivos

Authors

Jasmine Kaur Chawla [1]
Indu Bala [2]
Chanderkant Dhiman [3]
Prince Vishal Dixit [4]
Vismita Paliwal [5]
Barnali Bhattacharjee [6]
Seema Kaushik Sharma [7]

[1] Manav Rachna International Institute of Research and Studies (India)
[2]SGT University (India)
[3] Banaras Hindu University (India)
[4] NMSN Dass PG College (India)
[5] Deen Dayal Upadhyaya Gorakhpur University (India)
[6] K.R. Mangalam University (India)
[7] Lakshmibai College (India)

Corresponding author:
Jasmine Kaur Chawla
Jasmine.k.chawla@gmail.com

Received: 10-07-2025
Accepted: 18-09-2025

How to cite in APA

Kaur Chawla, J., Bala, I., Dhiman, C., Vishal Dixit, P., Paliwal, V., Bhattacharjee, B., & Kaushik Sharma, S. (2025). Psychological analysis of anxiety and its impact on athletic performance in competitive sports. *Retos, 72*, 1174-1185. https://doi.org/10.47197/retos.v71.117070

Abstract

Introduction: Effective performance in elite sport requires careful management of psychological factors, although the distinct contributions of cognitive and somatic anxiety were not fully understood.
Objective: The study aimed to examine how cognitive and somatic anxiety predicted objective performance outcomes and whether gender and sport typology moderated these relationships.
Methodology: A sample of 196 competitive athletes, representing both genders and a balance of individual and team sports, completed validated multidimensional anxiety measures. Standardized competition scores were used as objective performance indicators.
Results: Cognitive anxiety consistently showed a negative association with performance, explaining a meaningful proportion of variance in outcomes. Somatic anxiety displayed a curvilinear pattern, in which moderate levels of physiological arousal supported better results, while excessive activation reduced performance. Gender and sport type moderated these effects, with female athletes and those in individual sports experiencing stronger negative consequences of cognitive anxiety.
Discussion: The findings aligned with previous research highlighting the detrimental role of cognitive anxiety and the adaptive potential of moderate somatic arousal. They also confirmed that contextual variables such as gender and sport typology influenced the strength of anxiety–performance relationships.
Conclusions: Cognitive and somatic anxiety were identified as key predictors of athletic performance, underscoring the importance of individualized psychological support adapted to athlete profiles. A multidimensional and context-sensitive approach is essential for promoting well-being and sustained performance under competitive conditions.

Keywords

Cognitive anxiety; competitive anxiety; performance; somatic anxiety; sport typology.

Resumen

Introducción: El rendimiento en el deporte de élite exigió un manejo preciso de los factores psicológicos, aunque las contribuciones de la ansiedad cognitiva y somática no se comprendieron plenamente.
Objetivo: Analizar cómo la ansiedad cognitiva y somática predijeron el rendimiento objetivo y si el género y la tipología deportiva moderaron estas relaciones.
Metodología: Una muestra de 196 atletas competitivos, equilibrada en género y en deportes individuales y de equipo, completó medidas validadas de ansiedad multidimensional, y los puntajes estandarizados de competencia se utilizaron como indicadores objetivos de rendimiento.
Resultados: La ansiedad cognitiva mostró una asociación negativa consistente con el rendimiento, explicando una parte importante de la variabilidad. La ansiedad somática presentó una relación curvilínea: una activación moderada se asoció con mejores resultados, mientras que una excesiva redujo el rendimiento. El género y el tipo de deporte moderaron estos efectos, con consecuencias más negativas en las mujeres y en quienes practicaban deportes individuales.
Discusión: Los hallazgos coincidieron con la literatura que resalta el efecto perjudicial de la ansiedad cognitiva y el papel adaptativo de una activación somática moderada. También confirmaron que factores contextuales como el género y la tipología deportiva influyeron en la fuerza de estas asociaciones.
Conclusiones: La ansiedad cognitiva y somática fueron predictores clave del rendimiento, lo que subrayó la necesidad de un apoyo psicológico individualizado. Un enfoque multidimensional y sensible al contexto es esencial para promover el bienestar y un rendimiento sostenido bajo presión competitiva.

Palabras clave

Ansiedad cognitiva; ansiedad competitiva; ansiedad somática; rendimiento; tipología deportiva.

Introduction

Competitive sport demands a combination of physical capability and psychological resilience. Under intense pressure, competitive anxiety consistently predicts performance variability (Hufton et al., 2024; Lochbaum et al., 2022). Extensive reviews in sport psychology indicate that cognitive and emotional processes shape athletic motivation, performance, and well-being (Lochbaum et al., 2022; Robazza et al., 2022). Competitive anxiety, characterized by tension, apprehension, and autonomic arousal linked to competition demands, differs from generalized anxiety disorders in that it fluctuates dynamically across training and competition cycles (Tossici et al., 2024).

A substantial body of research demonstrates that anxiety in sport is best understood as a multidimensional construct. The present study is grounded in Multidimensional Anxiety Theory (MAT) as the primary theoretical framework, which differentiates between cognitive anxiety task-irrelevant worry, self-doubt, and negative expectations and somatic anxiety physiological arousal such as muscle tension, elevated heart rate, and "butterflies" in the stomach and predicts that these dimensions influence performance in distinct ways (Hufton et al., 2024; Lochbaum et al., 2022). MAT remains one of the most widely applied theoretical models in sport psychology because it provides specific, testable predictions about the form of these relationships. While Teixeira et al. (2021) propose a broader three-dimensional framework incorporating emotional responsiveness, recent research, including Córdova-Castillo et al. (2023), shows that this component has a limited direct association with objective performance indicators and contributes minimally to predictive models in competitive sport (Boas Junior et al., 2025; Lochbaum et al., 2022). By focusing on the cognitive and somatic components outlined in MAT, this research applies a theoretically coherent and empirically supported approach to examining the anxiety–performance relationship.

Meta-analytic syntheses give powerful evidence of these differentiated effects. Hufton et al. (2024) conduct a systematic review of decades of research and establish that high cognitive anxiety is always a predictor of a decline in performance. Lochbaum et al. (2022) stress that these effects depend on contextual and individual factors, one of which is the coping style of athletes. The ability of coping strategies to counteract the adverse effects of anxiety is also demonstrated by Doron et al. (2020), which is why adaptive psychological skills should be emphasized to cope with the stress caused by competition. The regulation of emotions is established as a major determinant of the relationship between psychological conditions and the performance of athletes (Boas Junior et al., 2025).

Gender is another personal variation that complicates the anxiety-performance relationship. The study conducted by Dhankar (2024) reveals that female athletes tend to report an elevated level of cognitive anxiety and swings of self-confidence as compared to male athletes. The tendency is in line with the literature that indicates gender to be intertwined with the coaching style, psychological needs, and perceived support, influencing the character of the appraisal and control of the anxiety symptoms (Jeong et al., 2022; Zhang et al., 2024). The findings indicate the importance of gender as a substantive moderator and not a demographic one.

The type of sport also plays a central role in the determination of anxiety reactions. The individual sports place it all on the individual, a factor that, in most cases, enhances self-centeredness and performance problems. Team sports, in their turn, distribute responsibility and provide common coping mechanisms (Kemarat et al., 2022; Terrón and Jiménez, 2023; Saniah et al., 2024). Research conducted in comparing the two contexts reveals that individual athletes are likely to have pre-competitive anxiety in the cognitive worry domain. The consequence of this difference on evaluation and intervention is something that cannot be ignored, since what works in one particular type of sport might not be the same in another. While psychological interventions such as mindfulness and biofeedback show potential in reducing competitive anxiety and improving attentional control (Wang et al., 2023), the present study does not evaluate these strategies; instead, it focuses exclusively on the statistical associations between cognitive and somatic anxiety and objectively measured performance outcomes in competitive sport. This emphasis ensures theoretical and methodological alignment with Multidimensional Anxiety Theory and maintains the study's focus on identifying performance-relevant psychological patterns rather than testing applied programs.

In the present study, objective performance is operationalized using standardized competition results, including verified rankings, times, scores, or qualification outcomes sourced from official event records.

These outcomes are defined as standardized competition results such as official rankings, times, or scores to enhance ecological validity and minimize biases associated with self-reported assessments. To ensure comparability across sport disciplines, performance indicators are z-standardized within each sport, with directionality adjusted where necessary (e.g., lower rankings reflecting superior performance). This procedure maintains statistical integrity while preserving the contextual relevance of sport-specific outcomes.

Despite substantial research on competitive anxiety, important gaps remain. Many existing studies treat anxiety as a unidimensional construct or focus primarily on cognitive aspects, overlooking the potential influence of somatic components. Few investigations examine these dimensions simultaneously while incorporating key moderators such as gender and sport typology, which may meaningfully alter anxiety–performance relationships (Dhankar, 2024; Kemarat et al., 2022). Moreover, most prior research relies on self-reported performance indicators, limiting the ecological validity of findings. There is a need for multidimensional, moderator-inclusive designs that use objective competition outcomes to better reflect real-world performance demands. Addressing these gaps, the present study applies Multidimensional Anxiety Theory to test how cognitive and somatic anxiety predict standardized performance results, and whether these relationships are moderated by gender and sport type.

Research objectives

- To examine how cognitive and somatic anxiety predict objective performance outcomes in competitive sports, using standardized indicators (rankings, times, scores)
- To test whether gender moderates the associations between anxiety dimensions and performance, reflecting potential gender differences in anxiety intensity and coping
- To assess whether sport typology (individual vs. team) moderates the relationships between anxiety and performance, expecting stronger negative effects of cognitive anxiety in individual sports

Method

Study Design

The research was a cross-sectional predictive correlational study based on Multidimensional Anxiety Theory. The method was chosen to estimate the distinct and the joint prediction of cognitive and somatic anxiety on objective performance outcomes, and whether gender and sport typology moderate these associations.

Participants

The sportspeople were competitive athletes who were recruited by recognized sports federations and training academies. The inclusion criteria required athletes to be at least 18 years of age, have a minimum of two consecutive years of competitive experience, and be actively participating in official competitions during the current season. All participants also provided consent for access to their verified performance data. An a priori power analysis using G*Power 3.1, based on a conservative small-to-moderate effect size estimate (f^2 = .08), indicated that a sample size of 160 was required to achieve 80% power at an alpha level of .05 for multiple regression models including interaction terms. This conservative value was selected to ensure adequate power even under the smallest effects anticipated. Because the planned analyses included quadratic terms and moderator effects (gender, sport type), and to allow for potential attrition or missing data, the target sample size was increased by approximately 25% to around 200 athletes. A stratified sampling approach was employed to ensure balanced representation across gender (male, female) and sport typology (individual vs. team sports). The final sample consisted of 196 athletes, exceeding the minimum requirement for statistical power. Post-hoc power analysis confirmed that this sample size provided >80% power to detect effects of the planned complexity, including quadratic and interaction terms. The observed overall model effect size after data collection (f^2 = .22) was larger than the conservative planning estimate, confirming that the obtained effects were stronger than expected, rather than conflicting with the a priori calculation. The sample included athletes from a diverse range of sports disciplines such as athletics, swimming, archery, badminton, football, basketball,

volleyball, and kabaddi. This selection ensured representation across endurance, skill-based, and team-oriented performance contexts, thereby enhancing the ecological validity of the findings.

Measures

Multidimensional Competitive Anxiety

The level of anxious competitiveness was measured with the help of the Three-Dimensional Anxiety Scale for Sport (Teixeira et al., 2021). This scale consists of cognitive anxiety (eight items), somatic anxiety (eight items), and emotional reactivity (four items). All of them were measured on a five-point Likert scale with the values that ranged between 1 (not at all) and 5 (extremely). Each subscale was scored independently, and in the present study, an analysis of cognitive and somatic anxiety was undertaken based on the Multidimensional Anxiety Theory. The subscales of the present study had an internal consistency greater than Cronbach's alpha of.85. Although Teixeira et al. (2021) validated a three-dimensional model of competitive anxiety, including cognitive anxiety, physiological (somatic) anxiety, and perceived control, the present study purposefully focused on the first two dimensions. This decision was guided by the theoretical scope of Multidimensional Anxiety Theory, which emphasizes the functional impact of cognitive and somatic anxiety on performance outcomes. While Perceived Control demonstrated acceptable psychometric properties in the original scale development, it was conceptually distinct from pre-competition anxiety states and showed limited direct alignment with physiological arousal or attentional disruption mechanisms central to performance prediction. Therefore, its exclusion was intended to preserve theoretical coherence and analytic parsimony within the MAT framework.

Objective Performance Outcomes

Objective performance outcomes were derived from official competition records, including final rankings, performance scores (e.g., points, times, or distances), and qualification status where applicable. To ensure comparability, results were first standardized within each sport/event (and sex category where relevant) before pooling. This method was chosen because the aim was to examine the relationship between anxiety and relative performance within each sport, not to compare absolute performances across different disciplines. This approach ensured that performance was interpreted relative to the distribution of results within the same sport, avoiding any claim of direct equivalence between fundamentally different disciplines. Directionality was adjusted so that higher values consistently reflected superior performance. For athletes with multiple indicators within their sport, a within-sport composite z-score was calculated to represent overall performance. The use of within-sport standardization is consistent with established sport performance analysis methods, where z-scores serve as a statistical scaling tool rather than a direct performance comparison metric across sports. To evaluate the robustness of this approach, supplementary analyses were conducted using (a) percentile rank transformations within each sport, (b) separate models for individual and team sports, and (c) mixed-effects models with sport/event entered as a random intercept. All robustness checks yielded substantively similar results to the main analyses. This multi-step procedure preserved the ecological validity of sport-specific outcomes while enabling statistical comparability across disciplines.

Demographic and Sport Variables

Participants reported their age, gender (male or female), sport typology (classified as individual or team), and years of competitive experience. Gender and sport type were coded as categorical moderator variables for analysis.

Procedure

After obtaining ethical approval, all participants provided informed consent. The anxiety questionnaire and demographic survey were administered between 24 and 72 hours before each athlete's primary competitive event, with the majority completing the measures in the 24–48-hour period. The inclusion of a small number of assessments up to 72 hours prior was necessary to accommodate unavoidable scheduling constraints such as travel or training commitments, while remaining within a timeframe considered stable for capturing pre-competition anxiety levels. This narrower window has been identified in prior research as a period of relative stability for competitive anxiety and was therefore used to

reduce temporal variability. To further account for potential fluctuations, the time interval between survey completion and competition was recorded for each athlete and included as a covariate in supplementary analyses; the inclusion of this variable did not alter the direction or significance of the main findings. All responses were anonymized and securely stored, and objective performance data were subsequently collected from official event records.

Data Preparation and Assumption Checking

The dataset was first screened for missing values, outliers, and violations of statistical assumptions. Mahalanobis distance was used to identify potential multivariate outliers, and Q–Q plots along with scatterplots of standardized residuals were examined to assess normality, homoscedasticity, and linearity. To reduce multicollinearity, all continuous predictors were mean-centered before creating interaction and quadratic terms. Missing data on study variables were minimal and assessed for randomness. The thresholds for handling missing data followed common methodological guidelines: cases with more than 20% missing data on key variables (anxiety measures or performance scores) were excluded to avoid bias from excessive imputation, as missingness above this level is widely considered too high for reliable estimation. For cases with less than 5% missing per variable, levels generally regarded as negligible and unlikely to affect results values were imputed using the expectation–maximization (EM) algorithm, which performs well under a missing-at-random assumption and retains statistical power. For cases with 5–20% missing data, EM imputation was applied only if missingness appeared random and the available data met consistency checks; otherwise, those cases were removed. Complete-case analyses were conducted as a sensitivity check, and results were consistent with the imputed data analyses.

Statistical Analyses

IBM SPSS Statistics (version 22) was used for all analyses, with the PROCESS macro (Model 2) employed to estimate moderation effects (Hayes, 2018). Descriptive statistics, including means, standard deviations, and Pearson correlations, were first computed for all study variables. Hierarchical multiple regression analyses were then conducted to examine the predictive contributions of cognitive and somatic anxiety to objective performance outcomes. To test for curvilinear effects, a quadratic term for somatic anxiety was created and entered in the second step of the regression. Only theory-driven moderator effects were tested, specifically the interactions of Cognitive Anxiety × Gender and Cognitive Anxiety × Sport Type, entered in the third step of the model. All continuous predictors were mean-centered before creating interaction and quadratic terms, and the model hierarchy was maintained in all analyses. Variance inflation factors (VIFs) were examined and were below 2.0 for all predictors, indicating no problematic multicollinearity. Given the final sample size of 196 and the number of predictors entered, post-hoc power analysis confirmed >80% power to detect small-to-moderate effects ($f^2 \geq .08$), ensuring adequate sensitivity for the quadratic and interaction terms while minimizing the risk of overfitting. When significant interactions were detected, simple slope analyses were conducted to probe the conditional effects. To improve estimation stability and account for potential non-normality, all regression coefficients were accompanied by bias-corrected bootstrapped 95% confidence intervals based on 5,000 resamples. False discovery rate (FDR)–adjusted p-values were also computed in supplementary analyses to account for multiple comparisons, with primary conclusions remaining unchanged. Statistical significance was set at $p < .05$, and effect sizes and 95% confidence intervals were reported for all key coefficients.

Results

Demographic and Training Characteristics

The cohort of participants was systematically characterized to provide a strong basis for interpreting the principal analyses. Table 1 describes the demographic and training features of the sample, including age, gender, sport typology, competitive experience, competition level, and weekly training exposure. The data is well balanced about male and female athletes who participate in either individual or team sports, and at a variety of levels of competitions, including regional and international. To strengthen representativeness, the sample included athletes from diverse disciplines such as athletics, swimming, archery, badminton, football, basketball, volleyball, and kabaddi. Competition levels were operationally

defined based on governing body criteria: regional (state-level qualifiers), national (inter-state or national-level championship participants), and international (participants in sanctioned international events). Training exposure referred to the average weekly hours engaged in structured sport-specific sessions, including skill drills, conditioning, and tactical preparation. The inconsistency in the results of the sample in terms of experience magnitude and intensity of training emphasizes the ecological validity of the sample and improves the applicability of the results. These variables were analyzed alongside psychological variables so as to put in perspective the multidimensional forces that determine performance results.

Table 1. Demographic and Training Characteristics of the Athlete Sample

Variable	n (%) or M (SD)
Age (years)	24.3 (4.9)
Gender	Male: 102 (52%) Female: 94 (48%)
Sport Type	Individual: 104 (53%) Team: 92 (47%)
Sports Represented	Athletics, Swimming, Archery, Badminton, Football, Basketball, Volleyball, Kabaddi
Years of Competitive Experience	6.2 (2.8)
Competition Level	Regional: 65 (33%) National: 98 (50%) International: 33 (17%)
Weekly Training Hours	8.5 (3.2)

Descriptive Statistics and Preliminary Analyses

A total of 196 competitive athletes (Mage = 24.3 years, SD = 4.9) completed all study measures. Of these, 102 (52%) identified as male and 94 (48%) as female. The sample was evenly distributed between individual sports (n = 104) and team sports (n = 92). Performance scores were standardized within each sport discipline and then pooled into z-scores to allow comparability across events. Table 2 presents descriptive statistics and bivariate correlations.

Cognitive anxiety scores were moderately high (M = 3.12, SD = 0.61), and somatic anxiety levels were somewhat lower (M = 2.84, SD = 0.67). While these levels are not clinically diagnostic, they reflect the elevated arousal typically observed in competitive athletic contexts and align with normative ranges found in sport psychology literature. Standardized performance scores ranged broadly (M = 0.02, SD = 0.97), with no evidence of ceiling or floor effects, as minimum and maximum scores fell within the theoretical range of the standardized scale.

Cognitive anxiety demonstrated a significant negative correlation with performance ($r = –.36$, $p < .001$), indicating that higher levels of worry and self-doubt were associated with poorer outcomes. Somatic anxiety was not significantly correlated with performance ($r = .09$, $p = .19$), suggesting the potential for non-linear or moderated effects explored in subsequent analyses. The correlation between cognitive and somatic anxiety ($r = .42$, $p < .001$) indicated a moderate association; however, variance inflation factors (all <1.8) and tolerance values (>0.55) confirmed that this correlation did not introduce problematic multicollinearity in regression models.

Assumption checks confirmed suitability for regression analyses. Residuals were approximately normally distributed (Shapiro–Wilk W = 0.991, p = .27), with skewness (–0.08) and kurtosis (0.21) values well within ±1, supporting normality assumptions. Scatterplots confirmed homoscedasticity. Multivariate outliers were evaluated using Mahalanobis distance (critical χ^2 (3) = 16.27), and no cases exceeded this threshold.

Table 2. Descriptive Statistics and Correlations among study variables (N = 196)

Variable	M	SD	1	2	3
Cognitive Anxiety	3.12	0.61	—		
Somatic Anxiety	2.84	0.67	.42***	—	
Performance (z-score)	0.02	0.97	–.36***	.09	—

Note: Variables numbered as follows: 1 = Cognitive Anxiety, 2 = Somatic Anxiety, 3 = Performance. p < .001.

Figure 1. Mean and Standard Deviation of Cognitive Anxiety, Somatic Anxiety, and Performance

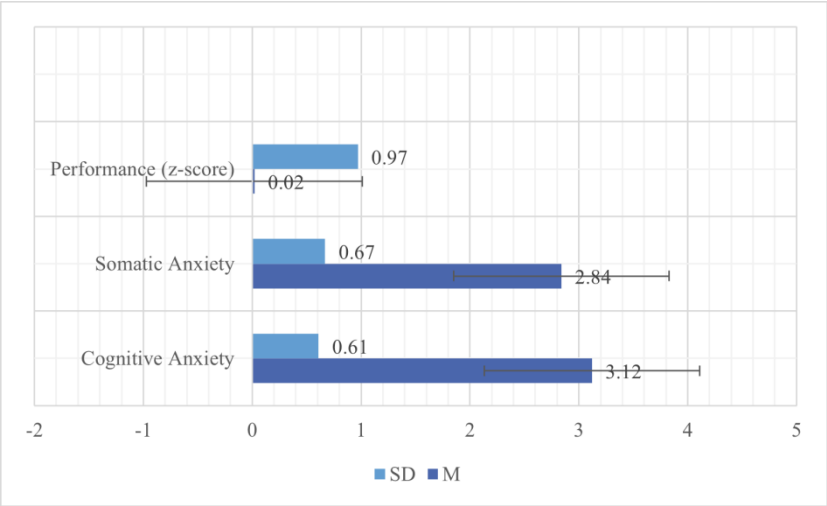


Figure 1. Mean (M) and standard deviation (SD) values for cognitive anxiety, somatic anxiety, and standardized performance (z-scores) among competitive athletes (N = 196). Blue bars indicate mean scores, orange bars indicate standard deviations, and error bars represent ±1 SD for each construct. Cognitive anxiety (M = 3.12, SD = 0.61), somatic anxiety (M = 2.84, SD = 0.67), and performance (M = 0.02, SD = 0.97) are shown in standardized units for comparability across sports.

Regression Analyses Predicting Performance Outcomes

Hierarchical multiple regression analyses were conducted to examine the predictive role of cognitive and somatic anxiety on standardized performance outcomes. All continuous predictors were mean-centered before forming interaction and quadratic terms to reduce multicollinearity.

In Step 1, cognitive anxiety alone significantly predicted performance scores and explained 13% of the variance in standardized performance ($\Delta R^2 = .13$, $F(1,194) = 28.95$, $p < .001$). Higher cognitive anxiety was associated with poorer performance ($\beta = -.36$, 95% CI [–.49, –.23], $p < .001$), consistent with prior research linking excessive worry to impaired competitive functioning.

In Step 2, both somatic anxiety and its quadratic term were entered to assess potential non-linear effects. This step accounted for an additional 5% of variance ($\Delta R^2 = .05$, F change $(2,192) = 5.82$, $p = .004$), yielding a final $R^2 = .18$ (Adjusted $R^2 = .16$). The corresponding effect size ($f^2 = .22$) represents a medium-to-large effect according to Cohen's conventions, suggesting that the combined influence of cognitive and somatic anxiety explains a practically meaningful portion of variation in athletic performance large enough to warrant consideration in coaching and psychological training programs.

The linear term for somatic anxiety was positive ($\beta = .19$, 95% CI [.03, .35], $p = .019$), while the quadratic term was negative ($\beta = -.17$, 95% CI [–.33, –.01], $p = .031$), indicating a significant inverted-U relationship between somatic arousal and performance. This supports the Multidimensional Anxiety Theory, suggesting moderate somatic activation may enhance outcomes, while too little or too much arousal may impair performance. To ensure robust inference, 95% bias-corrected confidence intervals were generated using bootstrapping (5,000 resamples), and effect sizes are reported in Table 3.

Given that multiple regression models and interaction terms were tested, the false discovery rate (FDR) method was applied to adjust p-values for multiple comparisons. All key effects, including the quadratic effect of somatic anxiety, remained statistically significant after correction (adjusted p-values < .05), reinforcing the robustness of the findings.

Table 3. Hierarchical Regression Predicting Objective Performance

Predictor	β	SE	t	p	95% CI
Step 1					
Cognitive Anxiety	–.36	0.07	–5.39	< .001	[–.49, –.23]
ΔR^2 (Step 1)					.13*

Step 2					
Somatic Anxiety	.19	0.08	2.37	.019	[.03, .35]
Somatic Anxiety^2	–.17	0.07	–2.17	.031	[–.33, –.01]
ΔR^2 (Step 2)					.05 (Additional)*

Note: N = 196. Outcome variable: standardized performance score. Confidence intervals reflect 95% bias-corrected intervals based on 5,000 bootstraps. *p < .05, ***p < .001.

Moderation Analyses

Moderation analyses were conducted using hierarchical regression models incorporating interaction terms to evaluate whether gender and sport typology significantly moderated the predictive relationships between cognitive and somatic anxiety and standardized performance outcomes, consistent with theoretical propositions that demographic and contextual factors can amplify or attenuate anxiety–performance associations.

Gender Moderation

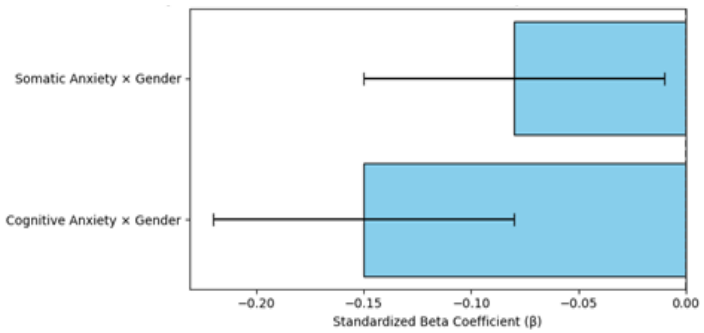
The interaction between cognitive anxiety and gender was significant (β = –.15, p = .037). Simple slopes analysis indicated that cognitive anxiety was more strongly negatively associated with performance among female athletes (β = –.46, p < .001) than among males (β = –.27, p = .008). No significant moderating effect was found for somatic anxiety by gender (p = .12). Table 4 shows that gender significantly moderated the impact of cognitive anxiety on performance (β = –.15, p = .037), with a stronger negative association observed among female athletes. This suggests that cognitive anxiety had a more pronounced detrimental effect on their outcomes. In contrast, the interaction between somatic anxiety and gender was not significant (β = –.08, p = .12), indicating no meaningful gender differences in the influence of somatic anxiety.

Table 4. The moderating effects of Gender

Interaction	B	SE	t	p
Cognitive Anxiety × Gender	–.15	0.07	–2.10	.037
Somatic Anxiety × Gender	–.08	0.07	–1.55	.12

Figure 2 displays standardized beta coefficients for the interaction terms assessing whether gender moderated the associations between anxiety and performance outcomes. The negative beta coefficients indicate that cognitive and somatic anxiety were more strongly associated with lower performance among female athletes compared to males. Specifically, the interaction between cognitive anxiety and gender was statistically significant (β = –0.15, p = .037), whereas the interaction involving somatic anxiety was nonsignificant (β = –0.08, p = .120). Error bars reflect ±1 standard error of the estimate, indicating the precision of each effect.

Figure 2. Interaction Effects of Gender on the Relationship Between Anxiety Dimensions and Performance



Simple Slopes for Cognitive Anxiety by Gender

Table 5 presents the results of simple slope analyses examining the relationship between cognitive anxiety and performance separately for male and female athletes. In both groups, higher cognitive anxiety

significantly predicted poorer performance. Among males, cognitive anxiety was negatively associated with performance (β = –.27, *p* = .008, 95% CI [–.45, –.08]). This effect was more pronounced among females (β = –.46, *p* < .001, 95% CI [–.61, –.30]), indicating a steeper decline in performance as cognitive anxiety increased. This pattern suggests that female athletes may be more susceptible to the performance-impairing effects of cognitive anxiety, possibly due to higher self-presentational concerns or lower access to coping resources in competitive environments. While both effects are statistically significant, the larger beta for females points to a practically meaningful difference that may warrant gender-sensitive psychological interventions in sport.

Table 5. Simple Slopes of Cognitive Anxiety Predicting Performance by Gender

Gender	β	SE	*t*	*p*	95% CI
Male	–.27	0.09	–3.00	.008	[–.45, –.08]
Female	–.46	0.08	–5.62	<.001	[–.61, –.30]

Note: SE = Standard Error; CI = Confidence Interval. β represents the unstandardized regression coefficient from simple slope analysis. Confidence intervals not crossing zero indicate statistically significant effects at p < .05.

Sport Typology Moderation

The interaction between cognitive anxiety and sport typology was also significant (β = –.14, p = .042). Among athletes in individual sports, the negative association between cognitive anxiety and performance was stronger (β = –.44, p < .001) than among team sport athletes (β = –.22, p = .019). No significant interaction was found for somatic anxiety (p = .18). These results indicate that the detrimental effect of cognitive anxiety is more pronounced in individual sports contexts. Table 6 shows that sport typology significantly moderated the relationship between cognitive anxiety and performance (β = –.14, p = .042), indicating that the negative association was stronger among athletes in individual sports. The interaction between somatic anxiety and sport typology was not significant (β = –.09, p = .18), suggesting no meaningful differences across sport types in the effect of somatic anxiety.

Table 6. Moderation Effects of Sport Typology

Interaction	β	SE	t	p
Cognitive Anxiety × Sport Typology	–.14	0.07	–2.04	.042
Somatic Anxiety × Sport Typology	–.09	0.07	–1.34	.18

Simple Slopes for Cognitive Anxiety by Sport Type

As presented in Table 7, simple slope analyses showed that cognitive anxiety was negatively associated with performance in both sport types. The effect was stronger among individual sport athletes (β = –.44, 95% CI [–0.60, –0.29], p < .001) than among team sport athletes (β = –.22, 95% CI [–0.40, –0.04], p = .019), indicating a steeper decline in performance with increasing cognitive anxiety in individual disciplines. These results suggest that individual sport contexts may exacerbate the psychological impact of cognitive anxiety on performance, supporting previous findings that solo competition environments intensify self-focus and evaluative stress.

Table 7. Simple Slopes of Cognitive Anxiety Predicting Performance by Sport Type

Sport Type	β	SE	t	p	95% CI
Individual	–.44	0.08	–5.50	<.001	[–0.60, –0.29]
Team	–.22	0.09	–2.41	.019	[–0.40, –0.04]

Note: SE = Standard Error; CI = Confidence Interval. β represents the unstandardized regression coefficient from simple slope analysis. Confidence intervals not crossing zero indicate statistically significant effects at p < .05.

Discussion

The present findings suggest that cognitive anxiety is a consistent and meaningful negative correlate of objective performance outcomes among competitive athletes, explaining approximately 18% of the var-

iance in standardized competition scores. While this association is correlational and does not imply causation, the size of the effect is notable within the realm of high-performance sport, where small psychological differences have a measurable influence on competitive outcomes. These results are consistent with theoretical perspectives indicating that sustained worry, self-doubt, and rumination are linked to reduced attentional control, working memory, and motor performance under pressure (Nicholls, 2021; Simpson et al., 2024; Lundqvist and Andersson, 2021). The study further shows that this negative relationship between anxiety and performance is moderated by gender and sport typology, emphasizing the importance of demographic and situational variables in shaping how anxiety relates to performance.

The finding that female athletes experience a greater drop in performance when cognitive anxiety is high aligns with prior literature on gender-related stressors in elite sport (Pascoe et al., 2022). Although mechanisms were not directly measured, these factors are highlighted in the literature as possible contributors and represent important areas for future research. Somatic anxiety does not show a significant moderation effect for gender, but the curvilinear pattern indicates that the role of physiological arousal in performance regulation is complex. This inverse-U relationship mirrors prior meta-analytic findings that moderate somatic activation facilitates readiness, attentional engagement, and reaction speed (Wang et al., 2023), whereas excessive arousal disrupts fine motor control. The pattern is also consistent with the Individual Zones of Optimal Functioning model, which posits individualized optimal arousal levels (Ronkainen et al., 2022). The present findings are most directly grounded in the Multidimensional Anxiety Theory, which informs the operational definitions, analytic strategy, and interpretation of results. Alternative frameworks provide theoretical triangulation, demonstrating convergence, though they are not empirically tested within this dataset.

The moderating effect of sport typology further underscores the contextual nature of the anxiety–performance link. Cognitive anxiety is more strongly associated with poorer performance in individual sport athletes than in team sport athletes, a pattern aligned with earlier work showing that individual competition heightens self-focus and perceived evaluative pressure (Simpson et al., 2024). As with gender differences, these mechanisms were not directly measured here and require targeted investigation before firm conclusions are drawn. Although prior research reports that the COVID-19 pandemic heightened athlete anxiety levels, particularly regarding mental health management in elite sport (Reardon et al., 2021; Carnevale Pellino et al., 2022), this study did not assess pandemic-related variables and therefore does not conclude their influence.

The presence of substantial unexplained variance indicates that other psychological and contextual factors, such as coping strategies, resilience, self-regulation skills, coaching behaviors, and organizational climate, also influence performance (Nicholls, 2021; Simpson et al., 2024). Supportive coaching environments buffer the negative effects of evaluative stress (Jeong et al., 2022). Advances in sports analytics, including machine learning applications, also provide new opportunities to identify complex patterns between stress and performance (Rico-Gonzalez et al., 2023). While this study does not evaluate interventions, the findings inform future research on strategies for managing competitive anxiety. Potential approaches worth investigating include mindfulness training, cognitive restructuring, and biofeedback, as prior studies show these interventions improve attentional control and reduce cognitive interference (Wang et al., 2023). Given the correlational nature of the current data, these recommendations remain exploratory and require direct testing in experimental or longitudinal designs before practical application.

Future research benefits from longitudinal and multimodal designs to capture temporal fluctuations in anxiety and performance, ideally using ecological momentary assessment. This approach allows identification of critical periods where interventions may be most effective. Examining interactions between dispositional traits (e.g., trait anxiety, perfectionism) and situational factors (e.g., injury recovery, selection pressure) deepens understanding of the multifactorial impact of anxiety on performance. Expanding this work to youth and underrepresented athlete populations strengthens generalizability. Overall, the study contributes to the literature by examining competitive anxiety as a complex, context-dependent, and correlational construct, reinforcing the value of targeted, adaptive, and interdisciplinary approaches to support athlete well-being and performance in elite sport.

Conclusions

The study demonstrated that cognitive and somatic anxiety were correlates of competitive performance, with cognitive anxiety accounting for 18% of performance variance and exerting particularly strong negative associations among female athletes and those in individual sports. Somatic anxiety showed an inverted-U relationship, confirming that moderate arousal was linked to better outcomes, while excessive activation was associated with poorer performance. These findings were consistent with the Multidimensional Anxiety Theory, which differentiated cognitive and somatic components, and with the Individual Zones of Optimal Functioning model, which emphasized personalized arousal thresholds. The moderating roles of gender and sport type indicated that the impact of anxiety was shaped by contextual and demographic factors. Female athletes appeared to face additional pressures, such as stereotype threat and evaluative concerns, which amplified cognitive interference. Although pandemic-related stressors were not directly assessed, persistent anxiety likely reflected residual challenges documented in recent research. The work achieved its objectives by clarifying how different anxiety dimensions affected objective performance and by identifying gender and sport typology as significant moderators. It contributed to the field by demonstrating that performance under pressure was influenced not only by physical ability but also by psychological regulation. Future research was suggested to adopt longitudinal and ecologically valid methods to track anxiety trajectories and intervention effects over time. Expanding investigations to culturally diverse samples and leveraging machine learning for real-time monitoring could further refine adaptive support models. The findings, therefore, provided practical implications for tailoring psychological interventions, such as mindfulness training, cognitive restructuring, self-talk techniques, and biofeedback, to promote mental well-being and sustained performance among athletes across competitive levels.

References

Boas Junior, M. V., Ucha, F. G., Souza, V. H. D., Manzini, M., Corrêa, M. D. F., Angelo, D. L., & Brandão, M. R. F. (2025). The relationship between emotional regulation and sports performance: A systematic review. *Journal of Physical Education,* 35, e3530. https://doi.org/10.4025/jphyseduc.35i1.3530

Carnevale Pellino, V., Lovecchio, N., Puci, M. V., Marin, L., Gatti, A., Pirazzi, A., & Vandoni, M. (2022). Effects of the lockdown period on the mental health of elite athletes during the COVID-19 pandemic: A narrative review. *Sport Sciences for Health,* 18(4), 1187-1199. https://doi.org/10.1007/s11332-022-00964-7

Córdova-Castillo, R., Brandão, R., Tutte-Vallarino, V., & Reyes-Bossio, M. (2023). Relationship between competitive anxiety and resilience in high-performance water sports practitioners during COVID-19. *Revista de Psicología Aplicada al Deporte y al Ejercicio Físico,* 8(1), e12. https://doi.org/10.5093/rpadef2023a12

Dhankar, M. (2024). Gender differences in sports performance and its related variables among young athletes. *International Journal of Interdisciplinary Approaches in Psychology, 2*(9), 209-323.

Doron, J., Rouault, Q., Jubeau, M., & Bernier, M. (2020). Integrated mindfulness-based intervention: Effects on mindfulness skills, cognitive interference, and performance satisfaction of young elite badminton players. *Psychology of Sport and Exercise,* 47, 101638. https://doi.org/10.1016/j.psychsport.2019.101638

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). The Guilford Press.

Hufton, J. R., Vella, S. A., Goddard, S. G., & Schweickle, M. J. (2024). How do athletes perform well under pressure? A meta-study. *International Review of Sport and Exercise Psychology*, 1-24. https://doi.org/10.1080/1750984X.2024.2414442

Jeong, J., Shim, Y., & Shin, M. (2022). Exploring the effects of coaching behavior on the mental conditioning process of Taekwondo Poomsae athletes: A moderated mediation effect of psychological needs and gender. *International Journal of Environmental Research and Public Health,* 19(12), 7016. https://doi.org/10.3390/ijerph19127016

Kemarat, S., Theanthong, A., Yeemin, W., & Suwankan, S. (2022). Personality characteristics and competitive anxiety in individual and team athletes. *PLoS ONE,* 17(1), e0262486. https://doi.org/10.1371/journal.pone.0262486

Lochbaum, M., Cooper, S., & Limp, S. (2022). The athletic identity measurement scale: A systematic review with meta-analysis from 1993 to 2021. *European Journal of Investigation in Health, Psychology and Education,* 12(9), 1391-1414. https://doi.org/10.3390/ejihpe12090097

Lochbaum, M., Stoner, E., Hefner, T., Cooper, S., Lane, A. M., & Terry, P. C. (2022). Sport psychology and performance meta-analyses: A systematic review of the literature. *PLoS ONE,* 17(2), e0263408. https://doi.org/10.1371/journal.pone.0263408

Lundqvist, C., & Andersson, G. (2021). Let's talk about mental health and mental disorders in elite sports: A narrative review of theoretical perspectives. *Frontiers in Psychology,* 12, 700829. https://doi.org/10.3389/fpsyg.2021.700829

Nicholls, A. R. (2021). *Psychology in sports coaching: Theory and practice.* Routledge.

Pascoe, M., Pankowiak, A., Woessner, M., Brockett, C. L., Hanlon, C., Spaaij, R., McEwan, D., & Parker, A. (2022). Gender-specific psychosocial stressors influencing mental health among women elite and semielite athletes: A narrative review. *British Journal of Sports Medicine,* 56(23), 1381-1387. https://doi.org/10.1136/bjsports-2022-105540

Reardon, C. L., Bindra, A., Blauwet, C., Budgett, R., Campriani, N., Currie, A., & Hainline, B. (2021). Mental health management of elite athletes during COVID-19: A narrative review and recommendations. *British Journal of Sports Medicine,* 55(11), 608-615. https://doi.org/10.1136/bjsports-2020-102884

Rico-González, M., Pino-Ortega, J., Méndez, A., Clemente, F., & Baca, A. (2023). Machine learning application in soccer: A systematic review. *Biology of Sport,* 40(1), 249–263. https://doi.org/10.5114/biolsport.2023.112970

Robazza, C., Morano, M., Bortoli, L., & Ruiz, M. C. (2022). Perceived motivational climate influences athletes' emotion regulation strategies, emotions, and psychobiosocial experiences. *Psychology of Sport and Exercise*, 59, 102110. https://doi.org/10.1016/j.psychsport.2021.102110

Ronkainen, N., Wiltshire, G., & Willis, M. (2022). Meta-study. *International Review of Sport and Exercise Psychology,* 15(1), 226-241. https://doi.org/10.1080/1750984X.2021.1931941

Saniah, S., Sukamti, E. R., Chaeroni, A., Prayoga, H. D., Prabowo, T. A., Suganda, M. A., & Abdhi, M. I. (2024). An analysis of Indonesian student-level boxing athletes: What effect does competition anxiety have on self-efficacy? *Retos,* 55, 1030–1037. https://doi.org/10.47197/retos.v55.106784

Simpson, R. A., Didymus, F. F., & Williams, T. L. (2024). Organizational stress and well-being in competitive sport: A systematic review. *International Review of Sport and Exercise Psychology,* 17(1), 116-144. https://doi.org/10.1080/1750984X.2021.1975305

Teixeira, K. C., Remus, J. B., & Nunes, C. H. S. D. S. (2021). Three-dimensional anxiety scale for sport: Development and validity evidence based on content. *Psico-USF,* 26(2), 241-251. https://doi.org/10.1590/1413-82712021260204

Terrón, B. S., & Jiménez, M. D. L. V. M. (2023). Precompetitive anxiety and psychological skills in sports performance. *Ansiedad y Estrés,* 29(2), 88-93. https://doi.org/10.5093/anyes2023a10

Tossici, G., Zurloni, V., & Nitri, A. (2024). Stress and sport performance: A PNEI multidisciplinary approach. *Frontiers in Psychology*, 15, 1358771. https://doi.org/10.3389/fpsyg.2024.1358771

Wang, Y., Lei, S. M., & Fan, J. (2023). Effects of mindfulness-based interventions on promoting athletic performance and related factors among athletes: A systematic review and meta-analysis of randomized controlled trials. *International Journal of Environmental Research and Public Health,* 20(3), 2038. https://doi.org/10.3390/ijerph20032038

Zhang, Z., Chen, X., Xu, L., Qin, X., & Veloo, A. (2024). Sport anxiety and subjective happiness of college athletes: A self-determination theory perspective. *Frontiers in Psychology*, *15*, 1400094. https://doi.org/10.3389/fpsyg.2024.1400094

Authors' and translators' details:

Jasmine Kaur Chawla	jasmine.k.chawla@gmail.com	Autor/a
Indu Bala	malhotra.indu1@gmail.com	Autor/a
Chanderkant Dhiman	dhimanchandu@bhu.ac.in	Autor/a
Prince Vishal Dixit	vishald362@gmail.com	Autor/a
Vismita Paliwal	vismitapaliwal@gmail.com	Autor/a
Barnali Bhattacharjee	barnali2734@gmail.com	Autor/a
Seema Kaushik Sharma	seemakaushik@lb.du.ac.in	Autor/a