



Emotional regulation and competitive outcome in combat sports: affective dynamics before and after matched bouts

Regulación emocional y resultados competitivos en deportes de combate: dinámica afectiva antes y después de combates pareados

Authors

Michele Andrade de Brito ¹
 José Raimundo Fernandes ^{1,2}
 Alejandro Vieira Andrade ³
 Otávio de Toledo Nóbrega ⁴
 Bianca Miarka ⁵
 Esteban Aedo-Muñoz ⁶
 Diego Valenzuela Pérez ⁷
 Pedro Henrique Lau Barbosa ²
 Keveenrick Ferreira Costa ¹
 Ciro José Brito ²

¹ Universidade Vale do Rio Doce, Brasil

² Universidade Federal de Juiz de Fora, Brasil

³ Faculdade Anhanguera de Governador Valadares, Brasil

⁴ Universidade de Brasília, Brasil

⁵ Universidade Federal do Rio de Janeiro, Brasil

⁶ Universidad Metropolitana de Ciencias de la Educación, Chile

⁷ Universidad Santo Tomás, Santiago, Chile

Corresponding author:
 Ciro José Brito
cirojbrito@gmail.com

Recibido: 16-08-25
 Aceptado: 01-10-25

How to cite in APA

de Brito, M. A., Fernandes, J. R., Vieira Andrade, A., Nóbrega, O. de T., Miarka, B., Aedo-Muñoz, E., Valenzuela Pérez, D., Lau Barbosa, P. H., Ferreira Costa, K., & Brito, C. J. (2025). Emotional regulation and competitive outcome in combat sports: affective dynamics before and after matched bouts. *Retos*, 73, 577-587. <https://doi.org/10.47197/retos.v73.117420>

Abstract

Purpose: This study investigated the predictive capacity of pre-competition emotions, post-competition emotional states, and emotional changes (delta) in determining competitive outcomes.

Methods: A total of 37 athletes (27 male, 10 female; age = 24.4±7.3 years) completed the Portuguese version of Sport Emotion Questionnaire (SEQ) before and after a competition. Five emotions (anxiety, sadness, anger, excitement, joy) were analyzed through descriptive statistics, parametric/non-parametric comparisons ($\alpha=0.05$), effect sizes (Cohen's d'/r'), and machine learning (logistic regression/Random Forest with 5-fold cross-validation).

Results: Pre-competition emotions showed no significant differences between winners ($n=18$) and losers ($n=19$), although the winners exhibited higher excitement (5.4 ± 4.2 vs. 2.5 ± 6.4 ; $d'=0.55$) and joy (5.9 ± 4.9 vs. 3.4 ± 7.0 ; $d'=0.41$), with anxiety identified as the top machine learning predictor (importance: 0.278). Post-competition, winners displayed significantly elevated levels across all emotions ($p<0.001$), particularly excitement (7.4 ± 4.8 vs. -1.2 ± 7.2 ; $d'=1.4$) and joy (8.8 ± 4.5 vs. -1.1 ± 8.0 ; $r=0.64$). Analysis of emotional deltas revealed winners' significant increases in excitement ($+2.00$; $p=0.018$) and joy ($+2.94$; $p=0.009$), versus losers' pronounced reductions in sadness (-6.89 ; $p=0.002$) and anger (-5.53 ; $p=0.003$). A predictive model using deltas achieved 78.2% accuracy, with delta joy as the strongest predictor ($OR=3.62$).

Conclusions: Emotional states after competition and their dynamic changes, characterized by amplification in winners and suppression in losers are stronger outcome determinants than pre-competition emotions. Interventions targeting adaptive emotion regulation may enhance athletic performance.

Keywords

Combat sports; competitive success; affective regulation; machine learning; sport psychology.

Resumen

Objetivo: Este estudio analizó la capacidad predictiva de las emociones previas a la competencia, los estados emocionales posteriores y sus variaciones (delta) en la determinación de los resultados competitivos.

Métodos: Treinta y siete atletas (27 hombres, 10 mujeres; 24,4±7,3 años) respondieron el Cuestionario de Emociones Deportivas (SEQ) antes y después de una competencia. Se evaluaron cinco emociones (ansiedad, tristeza, ira, excitación y alegría) mediante estadística descriptiva, pruebas paramétricas/no paramétricas ($\alpha=0,05$), tamaños del efecto y modelos de aprendizaje automático (regresión logística y Forest aleatorizado).

Resultados: No hubo diferencias significativas en emociones precompetitivas entre ganadores ($n=18$) y perdedores ($n=19$), aunque los ganadores mostraron mayor excitación ($d'=0,55$) y alegría ($d'=0,41$). La ansiedad emergió como el principal predictor en los modelos de aprendizaje automático. Tras la competencia, los ganadores presentaron niveles significativamente más altos en todas las emociones ($p<0,001$), con especial destaque en excitación ($d'=1,4$) y alegría ($r=0,64$). El análisis de deltas mostró incrementos significativos en excitación ($+2,00$) y alegría ($+2,94$) en ganadores, frente a reducciones en tristeza ($-6,89$) e ira ($-5,53$) en perdedores. El modelo predictivo basado en deltas alcanzó 78,2% de precisión, siendo el cambio en la alegría el predictor más robusto ($OR=3,62$).

Conclusiones: Los estados emocionales posteriores a la competencia y sus variaciones dinámicas predicen mejor el rendimiento que las emociones previas. Intervenciones dirigidas a una regulación emocional adaptativa podrían optimizar el desempeño deportivo.

Palabras clave

Deportes de combate; éxito competitivo; regulación afectiva; aprendizaje automático; psicología del deporte.



Introduction

High-performance sports demand multidimensional preparation encompassing technical, tactical, physical, emotional, and cognitive aspects (Campo et al., 2016; Chen, 2024). Within this context, analyzing athletes' emotional experiences provides valuable insights for enhancing sports performance (Chen, 2024; Fernández-Fernández et al., 2014). Thus, understanding the interaction between psychological parameters and the competitive environment is fundamental for optimizing athletic performance in combat sports (Ortega & Montero, 2021; Yang et al., 2020).

It is important to emphasize that emotions in competitive settings are characterized as individual, subjective, and momentary experiences, triggered by thoughts or affect-laden situations (Manuel C. Sánchez et al., 2019; Šukys et al., 2019). These experiences involve physiological (e.g., autonomic modulation) and behavioral components that enable individuals to cope with stimuli encountered during sports activities (Tiric-Campara et al., 2012; Villafaina et al., 2022), directly influencing athlete behavior and potentially facilitating or impairing competitive performance (Mojtahedi et al., 2023; Manuel C. Sánchez et al., 2019).

Specifically in combat sports, previous studies indicate that positive emotions and confidence in victory significantly reduce pre-competition anxiety (Cahyo et al., 2025; Kumar & Kumar, 2024; Kwamanakweenda et al., 2022; Yang et al., 2020). In this sense, Mojtahedi et al. (2023) reinforce this perspective by demonstrating the crucial role of mental toughness in regulating competitive anxiety. While extensive research has explored this relationship, a notable gap exists regarding studies examining dynamic emotional changes relative to fighters' competitive performance (Cahyo et al., 2025; Roy & Sahu, 2023; Slimani et al., 2016).

Emotion analysis holds significant practical relevance for training prescription, as incorporating psychological training into competitive preparation is a determining factor for achieving positive outcomes (Andrade et al., 2021; Andreato et al., 2022). When physical fitness is pushed to bodily limits, considering athletes' emotional dimensions becomes crucial (Friesen et al., 2017). It is important to highlight that combat sports requires quick decisions to be made under stress, so right or wrong choices will determine outcomes; under these conditions, emotional regulation and autonomic balance are critical differentiators (Ouergui et al., 2016). Despite this importance, studies have focused on analyzing the effect of previous emotions on competitive results (Fernández et al., 2020; Fernandez et al., 2023; Mojtahedi et al., 2023; Pesce et al., 2015; Yang et al., 2020), but to the best of our knowledge, no studies have analyzed post-competitive emotional changes in combat sports. Thus, this study aimed to evaluate whether pre- and post-competition emotions differentiate winners from defeated athletes and to examine the predictive capacity of emotional and autonomic changes (delta). We hypothesized that winners would exhibit greater pre-competition positive activation. Additionally, it is expected that emotional-autonomic changes would be more accurate predictors than absolute states.

Method

Experimental design and ethical considerations

This study is characterized as an observational, descriptive, and cross-sectional investigation with a quasi-experimental pre-post design (since no random allocation was applied), specifically developed to examine the psychological responses of combat sport athletes in a real-world competitive setting. The experimental protocol was structured to capture emotional variations at two critical time points: immediately before and immediately after each athlete's respective match. The study protocol was reviewed and approved by the Research Ethics Committee for Human Subjects at the Federal University of Rio de Janeiro (protocol no. 48167021.5.0000.5257), in accordance with the ethical guidelines outlined in Resolution 466/2012 of the Brazilian National Health Council.

Following ethical approval, the research team formally contacted the event organizers to present the study objectives, explain the methodological procedures, outline the minimal risks involved, and emphasize the voluntary nature of participation. Data collection was conducted on site during two competitive events featuring matched bouts, with 12 matches of mixed martial arts in each event. The sampling

was non-probabilistic based on convenience, since all athletes officially enrolled in the events were invited to participate. All 48 participating athletes were invited to take part in the study. Athletes who expressed interest in participating were thoroughly informed about the aims of the study, the procedures involved, potential benefits to the scientific and athletic communities, and their rights as research participants. Those who agreed to participate provided informed consent by signing the Institutional Review Board form.

Participants

The process of participant selection followed the principle of voluntary adherence. Inclusion criteria were: (a) athletes aged between 18 and 35 years; (b) active competitors officially registered in the event; and (c) individuals who demonstrated the ability to understand and follow the assessment procedures. Exclusion criteria included: (a) athletes who sustained injuries during competition, as physical trauma could significantly alter psychological responses; (b) participants who failed to complete all stages of data collection; and (c) athletes who reported the use of medications or substances which could interfere with the variables being measured.

Initially, 48 athletes expressed interest and successfully completed the pre-competition assessments. However, due to unforeseen circumstances, five losing athletes and six winning athletes did not attend or were unable to complete the post-competition assessments. These participants were therefore excluded from the final analysis to preserve methodological consistency and ensure data integrity. The final sample comprised 37 participants, divided between winners ($n = 18$) and losers ($n = 19$), which meets the minimum sample size typically recommended for detecting medium to large effects in psychological research with sufficient statistical power ($\geq .80$). According to Cohen (1992), a total sample of 34–36 participants are adequate to detect medium-sized effects (e.g., $d = 0.50$, $r = 0.30$) in independent t-tests or Mann–Whitney U tests with $\alpha = .05$. Furthermore, this sample size supports the use of logistic regression with a small number of predictors, as well as machine learning techniques such as Random Forest, particularly when combined with cross-validation procedures to reduce overfitting and enhance generalizability (Babyak, 2004).

Sociodemographic and sport-specific characterization

A structured sociodemographic questionnaire was administered to profile the participants and identify potential confounding variables. The instrument collected information about: (a) the highest competitive level achieved during the athlete's career; (b) average training session duration (in hours); (c) weekly training frequency (number of sessions); and (d) average hours of sleep per night.

Anthropometric assessment and body composition

Anthropometric measurements were conducted during the pre-competition phase, following standardized guidelines established by Farkas (1996) to ensure accuracy and reproducibility. Body mass was measured using a calibrated digital scale with a precision of 100g (LiderP-150M®, São Paulo, Brazil), with participants barefoot and wearing light clothing. Body density was estimated using a sport-specific equation developed and validated by Lohman (1992) for combat sport athletes. Body fat percentage was subsequently calculated using the equation proposed by Brožek et al. (1963).

Psychological assessment: Sports Emotions Questionnaire (SEQ)

Athletes' emotional states were assessed using the Portuguese version of SEQ, an instrument developed and validated by Gomes (2008) based on the theoretical framework of Jones et al. (2005). The SEQ was specifically designed to measure the subjective emotional experiences of athletes within competitive sport contexts. It encompasses five core emotional domains: (a) anxiety, characterized by feelings of apprehension and nervousness; (b) sadness, associated with dejection and melancholy; (c) anger, reflecting irritation and hostility; (d) excitement, representing states of arousal and enthusiasm; and (e) joy, corresponding to feelings of satisfaction and well-being. This structure allows for a balanced assessment of athletes' emotional experiences by including both negative emotions (anxiety, sadness, anger) and positive ones (excitement, joy).

Statistical analysis

Data was analyzed using Python software (version 3.11) with the library's pandas, scipy, scikit-learn, and matplotlib tools. An initial exploration analysis was conducted to assess data distribution and the presence of missing values. Shapiro–Wilk tests were used to compare emotional responses between groups (win vs. loss) to assess normality, followed by Student's t-tests for normally distributed data or Mann–Whitney U tests for non-parametric data. Effect sizes were calculated using Cohen's d for parametric tests and r for non-parametric tests. In turn, logistic regression and Random Forest models were applied to identify the most relevant pre-competition emotions associated with competitive outcome, with five-fold cross-validation used to assess predictive performance. Emotional change scores (delta = post – pre) were calculated for each participant and compared between groups using the same statistical procedures. Additionally, one-sample t-tests were performed to determine whether emotional changes significantly differed from zero. The significance level was set at $p < .05$, with further classification for $p < .01$ and $p < .001$. All analyses included the calculation of 95% confidence intervals and effect size metrics to interpret the magnitude of observed differences.

Results

Table 1 presents the anthropometric measurements of the two groups analyzed. There were no significant differences for these measurements ($p \geq 0.05$).

Table 1. Anthropometric measurements for the winners and losers, data presented as (Mean \pm Standard Deviation).

Measures	Winners (n=18)	Losers (n=19)	T calculated; p
Age (years)	21.9 \pm 7.9	21.8 \pm 5.7	T = 0.21; p = 0.81
Body Mass (kg)	68.4 \pm 11.6	74.6 \pm 10.3	T = 1.1; p = 0.14
Height (m)	1.7 \pm 0.1	1.7 \pm 0.1	T = 0.18; p = 0.88
BMI (kg/m ²)	22.5 \pm 3.0	24.5 \pm 1.9	T = 0.35; p = 0.25

The technical profile of the winning and losing fighters is presented in Table 2. Chi-squared analyses revealed no statistically significant associations ($p > 0.05$) between the investigated variables (professional experience, training time, training period, weekly frequency, and sleep duration) and competitive outcomes (winners vs. losers).

Table 2. Training, experience and combat sport characteristics between Winners and Losers.

Category	Subcategory	Winners (%)	Losers (%)	χ^2 calculated; p-value
Professional Experience	Local	25	11.1	$\chi^2 = 2.03$; p = 0.154
	Regional/National	75	88.9	
Training Time	< 24 months	50	66.6	$\chi^2 = 3.34$; p = 0.188
	24 to 36 months	8.3	11.2	
	> 36 months	41.7	22.2	
Training Period	Morning	25	11.1	$\chi^2 = 2.03$; p = 0.154
	Evening	75	88.9	
Weekly Frequency	2x per week	16.7	22.3	$\chi^2 = 2.67$; p = 0.445
	3x per week	41.7	55.5	
	4x per week	24.9	11.1	
	> 5x per week	16.7	11.1	
Hours of Sleep	4 to 6 hours	25	22.2	$\chi^2 = 0.06$, p = 0.806
	> 6 hours	75	77.8	

Figure 1 shows the emotion scores before the bout. Analyses of pre-competition emotional states revealed no statistically significant differences between winners and losers across the five measured emotions (all $p > .05$). However, moderate effect sizes were observed for anxiety (Cohen's d = 0.553), excitement (d = 0.546), and joy (d = 0.414), indicating that winners tended to present higher emotional activation and positive affect levels prior to the competition. Although these trends did not reach conventional levels of significance, machine learning models notably highlighted pre-competition anxiety as the most predictive variable of competitive outcome in both logistic regression (OR = 2.062) and in the Random Forest model (variable importance = 0.278). The overall predictive accuracy of these models remained modest, with 61.4% (SD = 17.7%) for logistic regression and 63.2% (SD = 29.7%) for Random Forest classification.



Figure 1. Boxplots of the five emotions assessed before the competition compare winners versus losers. No difference reached statistical significance ($p > 0.05$).

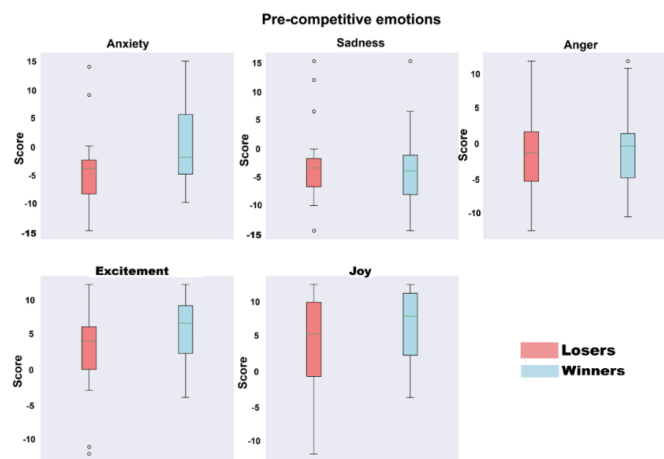


Figure 2 shows the post-competition emotions for winners and losers. In contrast, post-competition emotional profiles showed clear and statistically robust differences between groups. Winners reported significantly higher scores across all five emotional dimensions, including emotions typically considered negative, such as anxiety and anger. The most pronounced group differences were observed for joy ($M = 8.83 \pm 4.48$ vs. -1.11 ± 7.98 ; $r = 0.638$) and excitement ($M = 7.44 \pm 4.83$ vs. -1.16 ± 7.18 ; $d = 1.398$), both with large effect sizes. These results suggest that beyond positive affect, competitive success was associated with a heightened overall emotional state, whereas losers exhibited suppressed emotional responses across all dimensions.

Figure 2. Boxplots of the five emotions assessed after the competition comparing winners (blue) versus losers (red). All emotions showed highly significant differences ($p < 0.001$), with winners consistently showing higher levels. The symbols *** indicate statistical significance ($p < 0.001$).

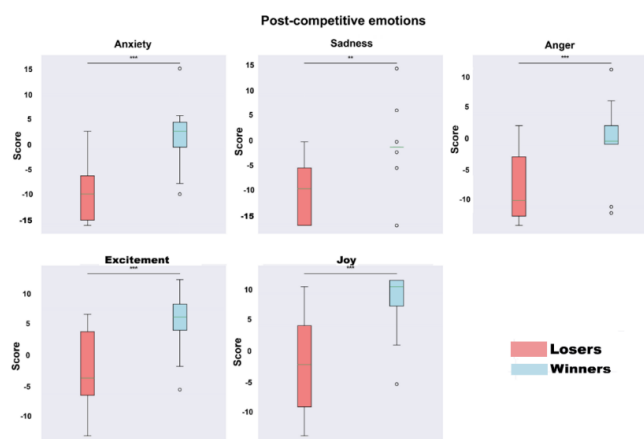
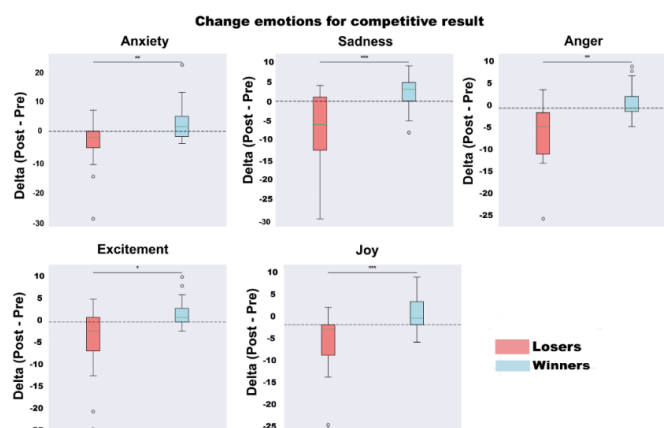


Figure 3 illustrates the changes in emotions (post-pre-competition) when comparing winners and losers.

Figure 3. Boxplots of emotional changes (post-pre-competition) for each emotion comparing winners (blue) versus losers (red). The horizontal dashed line at zero represents no change. All changes were significantly different between groups, with winners showing an emotional amplification pattern and losers a suppression pattern. The symbols *, **, and *** indicate significance levels $p < 0.05$, $p < 0.01$, and $p < 0.001$, respectively.



Emotional change scores (delta = post – pre) were significantly different between winners and losers for each emotion (all $p < .05$). Winners demonstrated significant increases in joy ($\Delta = +2.94 \pm 4.21$, $p = .009$) and excitement ($\Delta = +2.00 \pm 3.24$, $p = .018$), as well as a trend-level increase in anxiety ($\Delta = +3.11 \pm 6.39$, $p = .054$). In contrast, losers showed marked reductions in sadness ($\Delta = -6.89 \pm 8.42$, $p = .002$), anger ($\Delta = -5.53 \pm 7.02$, $p = .003$), and joy ($\Delta = -4.47 \pm 8.15$, $p = .028$). Predictive models based on delta scores yielded the highest classification accuracy among all analyses ($78.2\% \pm 11.4\%$). Logistic regression identified delta joy (OR = 3.616) and delta anger (OR = 2.314) as the most influential predictors; this pattern was corroborated by the Random Forest model, in which delta joy also ranked highest in importance (0.258).

Discussion

Emotional dynamics in competitive sports have long been recognized as influential factors in athletic performance, yet the mechanisms by which they contribute to success or failure remain complex and multifaceted (Andreato et al., 2022; Chen, 2024; Dias et al., 2025; Fernández et al., 2020). While prior research has often relied on laboratory settings or generalized measures of mood, the present study offers a novel contribution by assessing athletes in a real-world, high-stakes competitive environment (Mellalieu et al., 2009), specifically during matched bouts in combat sports (Bae et al., 2024; Mojtahedi et al., 2023). Emotional responses were measured both immediately before and after actual competitions, thus preserving ecological validity and capturing moment-to-moment affective fluctuations. Moreover, the study applied a delta-based analytical approach, not only focusing on static emotional states, but also on emotional change as a dynamic predictor of performance. In this context, our study examines whether pre-competition emotional states, post-competition emotional profiles, and emotional changes (delta scores) could discriminate between winning and losing outcomes. Contrary to our initial hypothesis, the findings revealed that pre-competition emotions did not significantly predict competitive results, although moderate trends suggested that winners tended to exhibit greater emotional activation and positivity prior to competition. However, our expectations regarding post-competition emotions and emotional deltas were confirmed: winners consistently reported higher emotional intensity across all dimensions after competition and showed an emotional amplification pattern, particularly in joy and excitement. Losers conversely displayed widespread reductions in emotional expression, particularly in sadness, anger, and joy, characterizing a suppressive emotional response. These findings support the notion that the capacity to regulate and adapt emotional states following performance, rather than initial emotional readiness alone, may play a more critical role in determining competitive success (Tomé-Lourido et al., 2023).

Nevertheless, our findings do not support previous studies which have suggested pre-competition emotions, such as anxiety and excitement, play a vital role in shaping an athlete's mental preparation and

competitive mindset (Chen, 2024; Kopp & Jekauc, 2018; Surur et al., 2025). Along these lines, past research has indicated that anxiety, often perceived negatively, can be harnessed in a constructive way in combat sports (Martínez-Rodríguez et al., 2019; Rice et al., 2016). Martínez-Rodríguez et al. (2019) demonstrated that pre-competitive anxiety increases physiological arousal, which may enhance an athlete's readiness and attentional focus. In this context, moderate anxiety may actually be beneficial, as the hormonal responses it triggers can support optimal preparation and ultimately improve performance (Ford et al., 2017; Manuel Castro Sánchez et al., 2019). The lack of baseline differences observed in our study may be explained by the specific nature of the competition analyzed (matched bouts), in which matchmakers deliberately aim to create balance between opponents (Table 2). This balancing goes beyond physical attributes and often includes psychological readiness, meaning that both athletes tend to enter the competition with similarly regulated emotional states. Indeed, this matchmaking strategy is commonly employed by organizations such as the Ultimate Fighting Championship (UFC) to promote fair contests, generate audience interest, and increase pay-per-view sales (Gift, 2024).

Although no statistically significant differences were found in pre-competition emotions between winners and losers, the data revealed meaningful trends. Winners tended to exhibit slightly higher levels of anxiety, excitement, and joy prior to competition, partially aligning with the "inverted-U" hypothesis of emotional activation, which posits that moderate arousal can enhance performance (McNally, 2002). These patterns suggest that athletes who maintain a moderate-to-high level of emotional activation, paired with a positive emotional tone, may be better psychologically prepared to engage in combat (Fernández et al., 2020; Fernandez et al., 2023). However, the absence of significant group differences challenges the idea that emotional states before competition are reliable predictors of performance outcomes.

This nuance reinforces the emerging perspective that static emotional states (though relevant) may be less critical than how athletes regulate and adapt those states during and after the competitive encounter (Kopp & Jekauc, 2018). Along this line, Samełko et al. (2020) state that even highly ranked athletes experience a blend of positive and negative emotions, which can release energy beneficial for performance. However, regulating these emotions through effective coping strategies is what leads to optimal outcomes in competitive contexts. It is also important to emphasize that the interpretation of anxiety plays a critical role in determining its impact on athletic performance (Friesen et al., 2017). In this regard, Rice et al. (2016) highlighted that athletes who perceive their anxiety as facilitative rather than debilitating are more likely to adopt effective coping strategies, which in turn enhance their performance levels. This appraisal-based perspective suggests that the same physiological symptoms of anxiety may lead to different outcomes, depending on how the athlete cognitively frames and responds to them.

Post-competition emotional responses clearly distinguished winners from losers in this study, with winners consistently reporting higher emotional intensity across all five dimensions, including both positive (e.g., joy, excitement) and negative emotions (e.g., anxiety, anger). This suggests that victory in combat sports is accompanied by heightened affective engagement, where the magnitude of the emotional response, rather than its valence, reflects the athlete's level of investment and perceived meaning of the outcome. These results align with the Theory of Challenge and Threat States in athletes, which posits that athletes who appraise competition as a challenge tend to experience more positive emotions and exhibit higher self-efficacy (Li et al., 2013). Similarly, Sazonova et al. (2024) argue that psychological readiness and emotional stability are essential for consistent goal attainment, with successful performance generating emotional outcomes (e.g., enthusiasm, reduced anxiety) that feed into motivational feedback loops. From this perspective, the amplified emotional profiles seen in winners may not only reflect the immediate satisfaction of success, but also a broader capacity for adaptive appraisal and emotional regulation. In contrast, the emotional flattening observed in losers, especially the suppression of joy and excitement, may represent a protective disengagement mechanism following perceived failure. Supporting this interpretation, Dunne et al. (2011) discuss how disengagement from unattainable goals may buffer against negative emotions, thereby reducing the psychological cost of perceived performance failure.

Emotional change scores proved to be the most robust predictors of competitive outcome, with winners displaying a clear emotional amplification pattern, particularly in joy and excitement, while losers showed emotional suppression, especially in sadness, anger, and joy. This finding supports the notion



that performance is not solely determined by emotional intensity at any single time point, but by the athlete's ability to dynamically modulate their emotional state in response to the demands and outcome of the competition. Such flexibility in emotional regulation may be a key psychological skill in high-performance contexts (Dias et al., 2025; Zhou et al., 2025). The predictive strength of delta scores (78.2% accuracy) further underscores the value of incorporating temporal and dynamic perspectives into sport emotion research. These results echo findings from applied sport psychology emphasizing that adaptive emotional transitions, rather than fixed emotional traits, may be more critical for resilience and competitive effectiveness (Galarraga et al., 2017). The ability to appraise performance scenarios in high-stress competitive environments as challenges rather than threats is essential for sustaining functional emotion-action links. Ruiz et al. (2020) emphasize that emotional and behavioral regulation strategies must be tailored to athletes' situational demands, with a focus on reframing thoughts and beliefs to preserve performance integrity. Complementarily, Kopp and Jekauc (2018) argue that the ability to identify, understand, and manage emotions is central to effective decision-making and long-term psychological development in competitive sport settings.

This study presents some advancements in the field of combat sport psychology. By assessing emotional states in combat sport athletes under real competitive conditions and not only analyzing pre- and post-competition scores, but also emotional changes over time, the study offers a dynamic and ecologically grounded perspective on affective processes in performance. The naturalistic design conducted during actual matched bouts enhanced ecological validity and enabled capturing authentic emotional fluctuations. Furthermore, including delta-based analysis and predictive modeling (e.g., logistic regression and Random Forest) represents a methodological strength which advances understanding of emotional regulation in applied sport settings. Although the sample size was relatively small ($N = 37$), it was sufficient to detect medium to large effects and allowed for robust inferential analyses. Moreover, the homogeneity of the sample in terms of sport and competition type, rather than being a limitation per se, ensured control over contextual variability and strengthened internal validity. Nonetheless, the findings should be interpreted with some caution, as factors such as personality traits, prior psychological training, or coping style were not assessed and may moderate emotional responses. Future studies with larger, more diverse samples and longitudinal designs could further clarify the mechanisms underlying emotional adaptation in sport. Still, the present findings provide meaningful contributions by identifying emotional flexibility, as reflected in change scores, as a critical psychological marker of competitive success.

Practical applications

The findings of this study offer several practical implications for coaches, sport psychologists, and athletes working in high-performance environments. First, rather than attempting to suppress pre-competition anxiety, practitioners should help athletes understand and reframe it as a potentially facilitative emotion. Psychological preparation strategies, such as cognitive restructuring, visualization, and controlled breathing, can help channel emotional arousal into productive states. Second, monitoring emotional changes before and after competition can serve as a valuable tool for identifying individual emotional regulation patterns. Athletes who consistently demonstrate emotional amplification in response to success may benefit from strategies to maintain motivation and focus, while those who show emotional suppression after defeat may require support to prevent withdrawal or disengagement. Lastly, integrating emotional flexibility training into regular routines through techniques like mindfulness, self-reflection, and emotion-focused coping, may enhance athletes' adaptability in competitive scenarios. By fostering awareness and regulation of emotional transitions, practitioners can contribute to both performance enhancement and long-term psychological resilience.

Conclusions

This study contributes to the growing body of literature emphasizing the importance of emotional regulation in competitive sports by demonstrating that emotional changes, not just baseline states, are key psychological markers of performance outcomes. While pre-competition emotions alone were not sufficient to predict success, post-competition emotional profiles, and most notably emotional change scores, clearly differentiated winners from losers. These findings underscore the relevance of assessing



emotional dynamics over time and suggest that athletes who are able to amplify or sustain emotional engagement after competition, particularly through increased joy and excitement, are more likely to achieve positive outcomes. From an applied perspective, these results highlight the potential value of developing interventions aimed at enhancing emotional flexibility and adaptive regulation in high-performance contexts.

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Author and translator details:

Michele Andrade de Brito	michele.psi1980@gmail.com	Author
José Raimundo Fernandes	mundegv@hotmail.com	Author
Alejandro Vieira Andrade	alejandrovieiraandrade@gmail.com	Author
Otávio de Toledo Nóbrega	otavionobrega@unb.br	Author
Bianca Miarka	bianca.miarka@gmail.com	Author
Esteban Aedo-Muñoz	esteban.aedo@usach.cl	Author
Diego Valenzuela Pérez	diegovalenzuela@santotomas.cl	Author
Pedro Henrique Lau Barbosa	02220225666@estudante.ufjf.br	Author
Keveenrick Ferreira Costa	keveenrickf@gmail.com	Author
Ciro José Brito	ciro.brito@ufjf.br	Author