The Official Journal of the International Society for Comparative Physical Education and Sport

REVIEW

Re-examining Athletes' Stress-Burnout Relationship: A Systematic Review and Meta-Analysis

Chien-Hsun Lin[a]; Frank J. H. Lu[b]; Yun-Che Hsieh[c]; Wei-Jiun Shen[b, d]
[a]Fu Jen Catholic University, Taiwan; [b]Chinese Culture University, Taiwan; [c]Army Academy, R.O.C., Taiwan; [d]National Taiwan Sport University, Taiwan

Keywords:
athlete burnout, mental health, meta-analysis, gender moderation, psychological well-being, stress management

Recommended Citation :
Lin, C-H., Lu, F. J. H., Hsieh, Y-C., & Shen, W-J. (2025). Re-examining Athletes' Stress-Burnout Relationship: A Systematic Review and Meta-Analysis. *International Sports Studies*, 47(2), 110-156, https://doi.org/10.69665/iss.v47i2.102

ORCID ID
Chien-Hsun Lin
https://orcid.org/0000-0003-1735-7615
Frank J. H. Lu
https://orcid.org/0000-0002-2613-6948
Yun-Che Hsieh
https://orcid.org/0000-0003-4071-6655
Wei-Jiun Shen
https://orcid.org/0009-0000-3443-1595

Abstract

To re-examine the impact of athletes' stress on burnout by extending the previous meta-analytic review conducted by Lin et al. (2022) and by investigating the additional moderators, including athletes' age, gender, sports experience, training load, athletic level, and region, within the stress-burnout relationship. Studies published between 2001 and April 2025 from five online academic databases were collected following PRISMA guidelines (Page et al., 2021) and evaluated using the 14 evaluation questions (Kmet et al., 2004). Fifty-nine eligible studies with 15,370 athletes were identified. The meta-analysis employing a random-effects model indicated a medium-to-large association between stress and burnout ($r = 0.478$, $p < .05$). Furthermore, athletes' stress-burnout relationship showed different patterns according to age, sports experience, training load, athletic level, and region. The athletes' stress-burnout association was confirmed, with variations across demographic, sport-specific, and cultural-regional factors. These findings highlight the need for tailored prevention programmes that integrate psychological strategies, coaching practices, and recovery monitoring to mitigate training-induced burnout across different developmental stages and cultural contexts.

Introduction

The pursuit of sporting excellence requires substantial physical, psychological, and emotional investment, yet this commitment often leads to burnout. Defined as emotional and physical exhaustion, reduced accomplishment, and sport devaluation (Raedeke & Smith, 2001), burnout typically emerges when prolonged stress from training demands, performance pressure, identity issues, and lack of control is not offset by adequate recovery. Athlete burnout is increasingly recognised as a serious issue with consequences extending beyond temporary fatigue or disengagement. It has been linked to declines in mental and physical health, including heightened symptoms of depression, anxiety, and sleep disturbances, as well as reduced life satisfaction and well-being (Glandorf et al., 2024; Glandorf et al., 2025). These outcomes can accumulate over time, hindering recovery, impairing performance, and undermining long-term development. Burnout also threatens athletes' career sustainability, being associated with diminished motivation, training withdrawal, and higher dropout rates (Cresswell & Eklund, 2005; Isoard-Gautheur et al., 2016). The urgency of addressing this issue is heightened by early specialisation, intensified competition schedules, and rising performance expectations, which increase the risk of

chronic stress and psychological exhaustion (Dišlere et al., 2025; Madigan et al., 2022). Collectively, these findings underscore the need to view athlete burnout as a multidimensional health and career risk that requires proactive, systematic investigation.

Burnout develops as a chronic stress process when athletes perceive an imbalance between situational demands and available coping resources (Smith, 1986). In his cognitive-affective model, Smith (1986) outlined four stages: (a) situational demands, such as intense training, competition pressure, and external expectations, which create high stress when seen as overwhelming; (b) cognitive appraisal, where burnout risk increases if athletes interpret these demands as threatening and doubt their ability to cope; (c) physiological responses, including fatigue, sleep problems, and anxiety, which undermine recovery and performance; and (d) behavioural responses, where accumulated strain leads to reduced performance, withdrawal from training, or even sport dropout. Several empirical studies have applied Smith's (1986) model to examine how stress contributes to burnout among athletes and under what conditions this occurs. Perceptual factors, including negative thinking and perceived distress, have been shown to mediate the stress-burnout relationship (Chang et al., 2017; Chyi et al., 2018). These findings highlight the nuanced roles of stress perceptions and emphasise that athletes' cognitive appraisal and coping confidence critically shape their vulnerability to burnout.

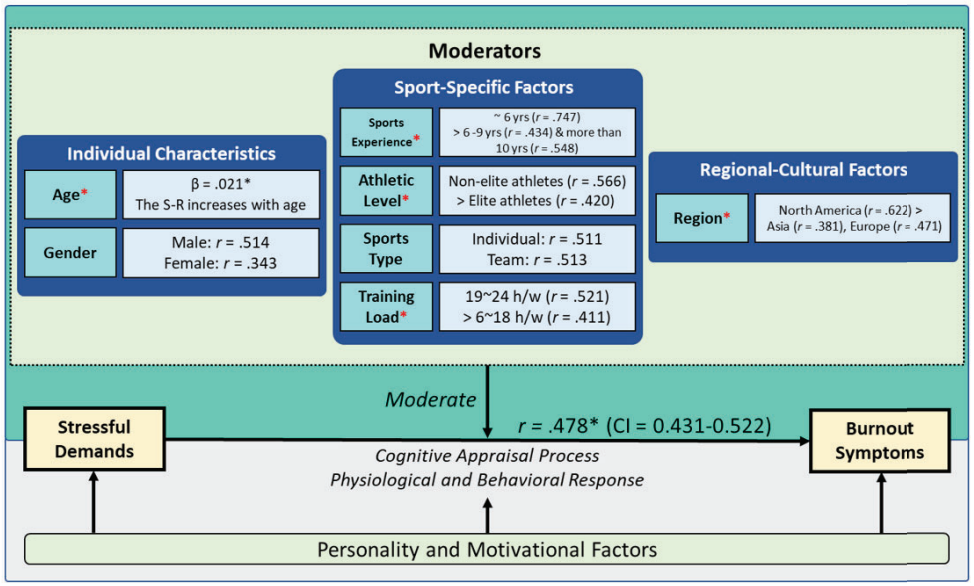
On the other hand, in line with the interactive nature of the cognitive-affective model, Lu et al. (2016) introduced a conjunctive moderation approach demonstrating that individual and environmental factors jointly buffer stress effects and found that athletes with greater resilience and stronger perceived social support from coaches exhibited lower burnout, even under high-stress conditions. Similarly, Wagstaff et al. (2018) confirmed resilience as a protective factor, showing its buffering role in the relationship between organisational stressors and burnout among both athletes and coaches. Hilpisch et al. (2024) further identified strong associations among burnout symptoms, effort-reward imbalance, emotional strain, and role conflict in elite athletes, while adequate social support and sporting success mitigated these effects. Complementing these findings, Shipherd et al. (2024) emphasised the role of cognitive appraisal, reporting that athletes with a negative stress mindset, perceiving stress as harmful, were more likely to experience burnout and consider sport withdrawal. Collectively, these studies underscore the significance of resilience, social support, and stress appraisal in shaping how and when stress translates into burnout, highlighting the critical interplay between personal and contextual resources in determining athletes' vulnerability.

Recently, Lin et al. (2022) conducted a systematic review and meta-analysis to quantify the relationship between athlete stress and burnout across multiple studies from 2001 to 2021. Their findings confirmed a strong association between athletes' stress and burnout (r = .505) and demonstrated that age and athletic level moderate this association. However, their scope of moderators was limited, leaving other potentially influential factors untested. Gender, sports experience, training load, sport type, and regional background may each contribute to systematic variation in the stress-burnout relationship. Training load has long been considered a central risk factor, as excessive weekly hours may increase stress responses and elevate the likelihood of exhaustion (Smith, 1986; Hamlin et al., 2019; Woods et al., 2025). At the same time, athletes with greater experience may have developed coping skills that allow them to buffer or reinterpret stressors more effectively (Crocker & Graham, 1995), whereas less experienced athletes often

remain more vulnerable to burnout (Dišlere et al., 2025). Gender also remains salient, as males and females often perceive and appraise environmental demands differently (Gill, 2020), and longitudinal evidence suggests that female athletes show higher baseline burnout trajectories than their male peers (Saarinen et al., 2025). Social context further shapes outcomes, with team-sport athletes typically reporting greater perceived social support, which is linked to reduced distress and lower risks of depression and anxiety (Pluhar et al., 2019; Reardon & Hitchcock, 2024). Finally, cultural values influence cognition and emotion, as collectivist versus individualistic orientations alter stress expression and coping strategies (Atkinson & Gim, 1989; Sun et al., 2004; Ma et al., 2025). Together, these findings indicate that heterogeneity in effect sizes across studies can be expected, highlighting the need to examine how demographic, sport-specific, and cultural moderators jointly shape the stress-burnout relationship. Despite its potential to influence the stress-burnout relationship, no meta-analysis to date has examined how these factors might moderate this relationship. Addressing this gap, the present study extends earlier reviews and provides novel insights into the mechanisms underlying variability in the stress-burnout association.

The purposes of our study were twofold. First, we aimed to extend Lin et al.'s (2022) work by examining the relationship between athletes' stress and burnout using a more comprehensive, updated meta-analytic approach. Second, as illustrated in Figure 1, we refined the cognitive-affective model of athletic burnout (Smith, 1986) by investigating the potential moderating roles of individual characteristics (i.e., age and gender), sport-specific factors (i.e., training load, athletic level, sport type, and sports experience), and regional-cultural factors (i.e., geographic region) on this relationship.

Figure 1. Extended model of the stress-burnout relationship for athletes and the moderating effects



Note. "yrs" refers to years, and "h/w" refers to hours per week. The lower part of the figure represents the core components of the cognitive-affective model of athletic burnout (Smith, 1986), while the upper part illustrates the moderating factors examined in the present meta-analysis.
*p <.05.

We hypothesised that there would be a significant relationship between athletes' stress and burnout, and that the variables would moderate this association (Dišlere et al., 2025; Madigan et al., 2022). Collectively, these findings underscore the need to view athlete burnout as a multidimensional health and career risk that requires proactive, systematic investigation.

Methods and Materials

This review was not pre-registered (e.g., in PROSPERO), as some academic journals do not require prospective registration as part of the submission process. Nevertheless, the study was conducted in accordance with established guidelines. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist (Page et al., 2021) to conduct the study. The detailed procedures are as follows:

Search strategy

A comprehensive search strategy was carefully designed to select eligible studies of athletes' stress and burnout, including diverse stress measures such as global perceived stress, general life stress, sport-specific stress, and burnout measures such as the Athlete Burnout Questionnaire (Raedeke & Smith, 2001) and the Shirom-Melamed Burnout Measure [SMBM] (Lerman et al., 1999). Five academic databases were searched: EBSCO, ProQuest, PubMed, OVID, and Web of Science (WOS). In addition, Google Scholar was used in a supplementary manner to trace reference lists and citations of eligible articles, ensuring that potentially relevant studies not indexed in major databases were not missed. All searches were limited to results from 2001 to April 2025. We used the following keywords, and Boolean operators (OR and AND) were added to combine them; they are: (1) burnout, (2) stress OR distress OR pressure, and (3) athlete* OR sport* OR player*. Only peer-reviewed publications available in English were included.

Eligibility criteria

In the first phase of this review, two authors employed the same methodology to search for relevant articles. In addition, the reference lists of selected papers were traced, and Google Scholar was used to identify further potentially relevant articles. In the second phase, two authors independently evaluated each article's title, abstract, and full text to determine its relevance to the athletes' stress-burnout relationship. Differences during article screening and coding were resolved through discussion between the two authors, and a third author was consulted to make the final decision when the disagreement remained. Thus, the included criteria of the articles were: (1) the topic or abstract of articles included life stress, general life stress, sport-specific stress, burnout, athletes/players, or sport, and presented the information about the associations between general life-stress or sport-specific stress and burnout; (2) the article had reported the sample size; (3) the participants were athletes; and (4) the article was published through peer-review, and (5) the study was in English. The exclusion criteria were as follows: (1) the study was not related to athletes' stress and burnout; (2) the study was only a literature or review; (3) the samples investigated were not athletes; and (4) the study abstract was not in English.

Accordingly, initial searches yielded 1,193 articles from online databases, and an additional 13 articles were obtained from Google Scholar. After removing duplicates, 350 articles remained. Next, the authors assessed the title, abstract, and full text of each identified study to determine its relevance to the review. The full texts of 92 articles were obtained and assessed. During the third stage of screening, articles were excluded based on the following criteria: (1) the study was not related to burnout or life-stress or sport-stress; (2) the full texts were not in English; (3) the data presented in the

results could not differentiate athletes and non-athletes; (4) the stress/burnout-related data were not presented in the results; (5) the study was not a quantitative analysis; (6) the samples were not athletes; (7) the scale used to measure stress was not suitable. Furthermore, four additional studies were identified through reference list tracing and were included after applying the same selection procedures. In total, 48 studies from Lin et al. (2022) and 12 newly identified studies (eight via databases and four via other methods) were included, yielding 60 studies for analysis (Figure 2).

Article quality assessment

We adopted the 14 evaluation questions proposed by Kmet et al. (2004) for quality assessment, including sample size, number of genders, demographic characteristics of the sample, statistical method, reliability and validity of the measurement, and conceptualisation of measurement in line with the topic. The sum of all these criteria scores would be the article assessment's total score. Furthermore, the study's quality was classified as high, low, or unclear based on the score. A sport psychology peer expert independently coded article quality using the same criteria, and only studies rated as moderate or higher were retained (Table 1). One low-quality study (score = 13, 59%) was excluded, resulting in 59 studies included in the final analysis.

Figure 2. PRISMA Flow Chart of the Studies Included in the Systematic Review and Meta-Analysis

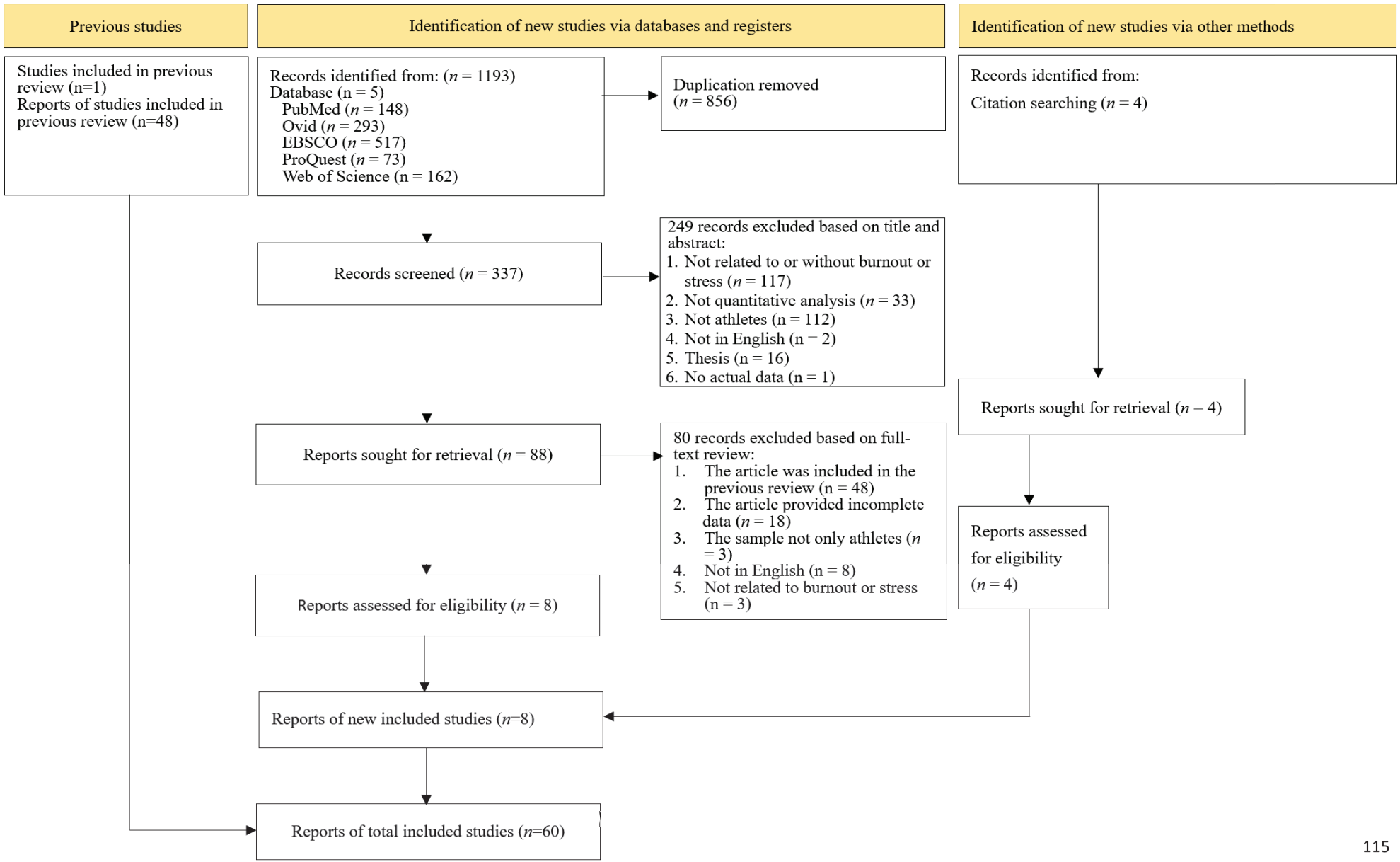


Table 1. Quality Assessment of the Included Studies

NO	Author(s)	Score items (Yes [2]/partial [1]/no [0])														Quality assessment (at least moderate quality 60%=17)
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	
1	Raedeke & Smith (2001)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
2	Raedeke & Smith (2004)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
3	Black & Smith (2007)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes		yes	no	yes	yes	18
4	Grobbelaar et al. (2010)	yes	yes	yes	yes	n/a	n/a	n/a	yes	partial	yes	yes	no	yes	yes	19
5	Main et al. (2010)	yes	yes	yes	yes	n/a	n/a	n/a	partial	partial	yes	yes	no	yes	yes	18
6	Smith et al. (2010)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
7	Gustafsson et al. (2011)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
8	Gustafsson & Skoog (2012)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
9	Lu et al. (2012)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
10	Gustafsson et al. (2013)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
11	Raedeke et al. (2013)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	partial	19
12	DeFreese & Smith (2014)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
13	Martinent et al. (2014)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	partial	19
14	Nafian et al. (2014)	yes	yes	yes	partial	n/a	n/a	n/a	partial	yes	yes	partial	no	no	no	13
15	Dubuc-Charbonneau & Durand-Bush (2015)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
16	Gustafsson et al. (2015)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
17	Martinent & Decret (2015a)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
18	Martinent & Decret (2015b)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	partial	19
19	Moen, Federici, & Abrahamsen (2015)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
20	Moen, Abrahamsen, & Furrer (2015)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	partial	19
21	Wang et al. (2015)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	partial	19
22	Chiu et al. (2016)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
23	De Francisco et al. (2016)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	partial	19
24	Lu et al. (2016)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
25	Chang et al., (2017)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
26	Frank, et al. (2017)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
27	Gustafsson et al. (2017)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
28	Lee et al. (2017)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
29	Chyi et al., (2018)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
30	Garinger et al., (2018)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
31	Gerber, Best, & et al. (2018)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
32	Gerber, Colledge, & et al. (2018)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20

33	Gerber, Gustafsson, & et al. (2018)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
34	Liu et al., (2018)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
35	Lu et al., (2018)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
36	Martinent et al. (2018)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
37	Gabana et al. (2019)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
38	Moen et al. (2019)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
39	Raanes et al., (2019)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
40	Åkesdotter et al. (2020)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
41	Chiou, et al. (2020)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
42	Dobson, et al. (2020)	yes	yes	yes	yes	n/a	n/a	n/a	yes	partial	yes	yes	no	yes	yes	19
43	Nixdorf, et al. (2020)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
44	Vaughan et al. (2020)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
45	Fagundes et al. (2021)	yes	yes	yes	yes	n/a	n/a	n/a	yes	partial	yes	yes	no	yes	yes	19
46	Wu et al., (2021)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
47	Daumiller et al. (2022)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
48	Glandorf et al. (2022)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
49	Liu et al., (2022)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
50	Martinent et al. (2022)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
51	Olsson et al. (2022)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
52	Woods et al. (2022)	yes	yes	yes	yes	n/a	n/a	n/a	yes	yes	yes	yes	no	yes	yes	20
53	Wu et al. (2022)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
54	Gerber et al. (2023)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
55	Malele & Noorbhai (2023)	yes	yes	yes	yes	n/a	n/a	n/a	partial	yes	yes	yes	no	yes	yes	19
56	Yang et. al. (2023)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
57	Woods et al. (2023)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
58	Gao & Wang (2024)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
59	Levillain et al. (2024)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20
60	Yu et al. (2025)	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	yes	20

Note. **A**: Is the question/objective sufficiently described? **B**: Is the study design evident and appropriate? Is the method of subject or comparison group selection, as well as the source of information and input variables, described and appropriate? Are the subject (and comparison group, if applicable) characteristics sufficiently described? **E**: Was the interventional and random allocation possible? Was it described? **F**: Was interventional and blinding of investigators possible? Was it reported? **G**: Was interventional and blinding of subjects possible? Was it reported? **H**: Outcome and (if applicable) exposure measure(s) well defined and robust to measurement/misclassification bias? Means of assessment reported? **I**: Is the sample size appropriate? J: Are the analytic methods described and justified as appropriate? K: Is some estimate of variance reported for the main results? **L**: Controlled for confounding? M: Are the results reported in sufficient detail?; **N**: Conclusions supported by the results?

Data extraction

We extracted the study characteristics (author's name, year of publication) and participant characteristics (sample size, mean age, athletic level, training experience, sport type, and gender) for each study. Additionally, we obtained measurements of global perceived stress and burnout, including the mean, standard deviation, and correlation coefficient. Inter-rater reliability (ICC) was examined across 60 included studies, with two authors achieving high agreement (ICC (2, 1) = .98). Coding disagreements were rare; in only one case, one author suggested inclusion while the other noted that school burnout should be included in student-athlete populations. After consulting a third reviewer, all authors agreed to exclude this non-sport-specific burnout data.

Moderator coding

To explore potential sources of heterogeneity, seven moderators were selected based on theoretical and empirical evidence: age, gender, sports experience, athletic level, sport type, training load, and athletes' regional background. Specifically, gender was defined as biological sex (male or female), supported by evidence that gender differences influence stress perception and coping responses (Gill, 2020; Saarinen et al., 2025). Age was measured as chronological age, reflecting developmental changes in stress-burnout trajectories. Sports experience was operationalised as years of sport participation and classified into three groups (<6 years, 6–9 years, ≥10 years) following the developmental model of sport participation (Côté et al., 2007). Empirical findings suggest that greater experience enhances coping resources, whereas less experience is associated with greater vulnerability to burnout (Crocker & Graham, 1995; Dišlere et al., 2025). Athletic level was defined as elite (national or international competitors) versus non-elite, reflecting differences in competitive demands and stress exposure. Sport type was categorised as team versus individual sports, consistent with findings that team contexts provide more social support, which buffers against psychological distress (Pluhar et al., 2019; Reardon & Hitchcock, 2024). Training load was defined as weekly training hours. Consistent with the NCAA (2016), which sets 20 hours per week as the upper limit for student-athletes' countable athletically related activities, and considering the reported ranges across studies, we classified training load into two categories: 6–18 hours and 19–24 hours per week. This classification also assumed six weekly training sessions with integer-hour durations, aligning with the practical structure of training schedules. Training load has long been considered a central risk factor, as excessive weekly hours can elevate stress responses and increase the likelihood of exhaustion (Smith, 1986; Hamlin et al., 2019; Woods et al., 2025). Finally, regional classification was based on cultural-geographic background, acknowledging that cultural norms shape cognition, emotion, and stress appraisal. Research has shown that collectivist versus individualistic orientations lead to different stress expression and coping strategies (Atkinson & Gim, 1989; Sun et al., 2004; Ma et al., 2025). A summary of moderator definitions and classifications is presented in Table 2.

Table 2. The definition and categorisation of moderator

Moderator	Definition	Categories
Gender	Biological sex	Male / Female
Age*	Chronological age / years from birth	Continuous variable
Sports experience*	Years of sport participation	< 6 years / 6–9 years / 10 years and above
Athletic level*	Classification of athletes based on their competitive experience	Elite (national or international competitor) / non-elite (others)
Sports type	Type of sport participation	Team / Individual
Training load*	Weekly training hours	6–18 hours / 19–24 hours
Region*	Continent	Asia / Europe / North America

Note. *p <.05 in the moderation test.

Statistical analysis

We used Comprehensive Meta-Analysis (CMA) version 2.0 to analyse the stress-burnout relationship across studies and to conduct the estimation of overall effect sizes, test for heterogeneity, and conduct moderator analyses. The Q-statistic was used to examine whether the actual effect size varied between studies when a random-effects model was applied (Field & Gillett, 2010). This test examines whether the variability across studies exceeds what would be expected by chance. A significant Q value reflects heterogeneity between samples. Higgins et al. (2003) reported that I^2 indicates different levels of heterogeneity: 25% (low), 50% (moderate), and 75% (high). I^2 represents the percentage of total variation across studies that is due to heterogeneity rather than random error. Therefore, I^2 statistics were used to interpret the magnitude of heterogeneity for significant Q values. A random-effects model was applied throughout the analysis, as it accounts for expected heterogeneity across studies, particularly when I^2 values were high. Furthermore, τ^2 was estimated as the between-study variance to quantify the absolute amount of heterogeneity across studies. Prediction intervals (PI) were also calculated to indicate the expected range of true effects in future studies. In addition, sensitivity analysis was performed by omitting individual studies to examine whether the overall results changed substantially when any single study was removed, thereby testing the stability of the meta-analysis.

In meta-analytic studies, publication bias frequently arises from the exclusion of unpublished or non-significant studies. To assess potential publication bias, we employed two methodological approaches: the Fail-safe number (N, Nf.s) analysis (Field & Gillett, 2010) and funnel plot examination (Verhagen & Ferreira, 2014), where a large fail-safe number indicates that many unpublished studies with null results would be needed to overturn the observed effect, suggesting robust findings. Funnel plots provide a visual inspection of distribution symmetry, where asymmetry may indicate potential publication bias. We also employed the Begg test (Begg & Mazumdar, 1994) and the Egger regression (Egger et al., 1997) to assess publication bias, which formally evaluate funnel plot asymmetry and provide statistical evidence of potential bias.

Regarding the moderation test, age (a continuous variable) was tested using meta-regression (a meta-analytic method testing how continuous study-level variables explain effect size variation), whereas the other categorical moderators were examined using subgroup analysis (a method that compares pooled effect sizes

across predefined study subgroups to assess between-group differences).

Effect sizes were calculated within the *r* family of measures, representing the strength of association between two variables on a numeric scale (Kline, 2004; Rosenthal, 1991). When reported, correlation and sample size values, means (*M*s) and standard deviations (*SD*s), or Fisher's *Z* values were entered directly. If correlation coefficients were unavailable, data were converted to r values using established formulas (see Formula 1; Borenstein et al., 2009; Chang, 2021). Because the variance of correlation coefficients changes with their magnitude, Fisher's *r*-to-*Z* transformation was applied for standardisation prior to pooling (see Formula 2), and combined estimates were subsequently weighted and aggregated (see Formula 3) before being back-transformed to *r* values (see Formula 4) for interpretation. According to Cohen (1988), *r* values of .10, .30, and .50 indicate small, medium, and large effect sizes, respectively. Forest plots were used to present effect sizes and 95% confidence intervals (CIs), where significance was inferred if the CI did not include zero at $p < .05$ (Verhagen & Ferreira, 2014). Forest plots also illustrated the distribution of effect sizes across studies (Marks-Anglin et al., 2021). Each study contributed a single effect size representing the stress–burnout association to avoid overweighting multi-effect studies.

The formulas used for effect-size transformations were as follows:

Formula 1. Conversion from *M* and *SD* to *r*.

$$d = \frac{M_2 - M_1}{\sqrt{\frac{(n_1-1)SD_1^2+(n_2-1)SD_2^2}{(n_1+n_2)}}}, r = \frac{d}{\sqrt{d^2+\frac{(n_1+n_2)^2}{n_1 \times n_2}}}$$

Formula 2. *r* to Fisher's *Z*.

$$Zr_i = \frac{1}{2} Ln\left(\frac{1+r_i}{1-r_i}\right), Var_{(Zr)} = \frac{1}{n-3}$$

Formula 3. Combining Fisher's *Z*.

$$Zr_{combined} = \frac{\sum w_i Z r_i}{\sum w_i}, \quad w_i = \frac{1}{Var(Z_{ri})}$$

Formula 4. Back-transforming Fisher's *Z* to *r*.

$$r_{combined} = \frac{e^{2zcombined} - 1}{e^{2zcombined} + 1}$$

Results

Description of study characteristics

Fifty-nine studies were included; most studies were conducted in Europe (*n* = 31) and Asia (*n* = 16). At the country level, Taiwan conducted the most studies (*n* = 10), followed by Sweden (*n* = 7), the United States (*n* = 7), France (*n* = 6), Norway (*n* = 4), Switzerland (*n* = 4), Germany (*n* = 3), the UK (*n* = 3), and other countries. Most samples included both male and female athletes, whereas four studies focused exclusively on males and one on females.

Regarding training experience, 27 studies involved athletes with 6–9 years of participation, and only two studies reported more than 10 years of training. As for training load, 26 studies did not specify the duration of participation. The training load was mainly between 6 and 24 hours per week. Additionally, most studies' samples included individual and team sports, with 12 studies focusing on individual sports athletes. Furthermore, considering the study design of the included articles, longitudinal studies were fewer in number than cross-sectional studies, with 14 and 45 articles, respectively. With respect to research design, cross-sectional studies predominated (*n* = 45), compared with longitudinal studies (*n* = 14) and intervention studies (*n* = 4). One mixed-method study combined cross-sectional data and physiological testing. In total, 20 studies collected data using online questionnaires or web-based measurements.

As for measures, most studies used the Athletes Burnout Questionnaire (Raedeke & Smith, 2001) to assess athlete burnout (56), while four studies employed the Shirom-Melamed Burnout Measure (Lerman et al., 1999) (see Table 3). As stress measures, 29 studies used Cohen et

al.'s (1983) Perceived Stress Scale (PSS); Eight studies used the Recovery-Stress Questionnaire for Athletes (REST-Q; Kellmann & Kallus, 2001); Five studies employed the Depression Anxiety Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995); Ten studies used the College Student-Athletes' Life Stress Scale (CSALSS; Lu et al., 2012); and one study used the organisational stressor indicator for sport performers (OSI-SP; Arnold et al., 2013).

Detailed characteristics of the 59 included studies are presented in Supplementary Appendix A.

Sensitivity analysis

Sensitivity analysis determines the robustness of the results of each study. We removed one study at a time from the analysis to assess the change in the overall effect size when that article was excluded. Our sensitivity analysis revealed that the exclusion of individual studies led to I^2 values ranging from 92.946 to 94.297, showing little change compared with the overall analysis I^2 value of 94.197, indicating that the meta-analysis was generally robust.

Table 3. The measures that were used in the 59 included articles

Item		N	Measurements$_{(n)}$
Burnout		60	ABQ (56); SMBM (4)
Stress		61	
	LS	32	PSS (21); CSALSS (3); DASS (3); TICS (2); BSI (1); RESTQ (1); SCI (1)
	Both LS and SS	16	RESTQ (6); CSALSS (7); SSPEHS (1); PSS (2)
	SS	13	PSS (in a sports setting, 6); RESTQ-S (1); DASS (in a sports setting, 2); ARSS (2); OSI-SP (1); APSQ (1)

Note. 1. For burnout measures: ABQ: Athletes Burnout Questionnaire; SMBM: Shirom-Melamed Burnout Measure; 2. For stress measures: PSS: Perceived Stress Scale; CSALSS: College Student–Athletes' Life Stress Scale; DASS: Depression Anxiety Stress Scales; TICS: Trier Inventory of Chronic Stress; BSI: Behavioral Symptom Inventory; RESTQ: Recovery-Stress Questionnaire for Athletes; SCI: Stress and Coping Inventory; SSPEHS: Stress Scale for Physical Education High School Student SS: Acute Recovery and Stress Scale; OSI-SP: Organizational Stressor Indicator for Sports Performers; APSQ: Athlete Psychological Strain Questionnaire. 3. LS: General life stress; SS: Sport-specific stress.

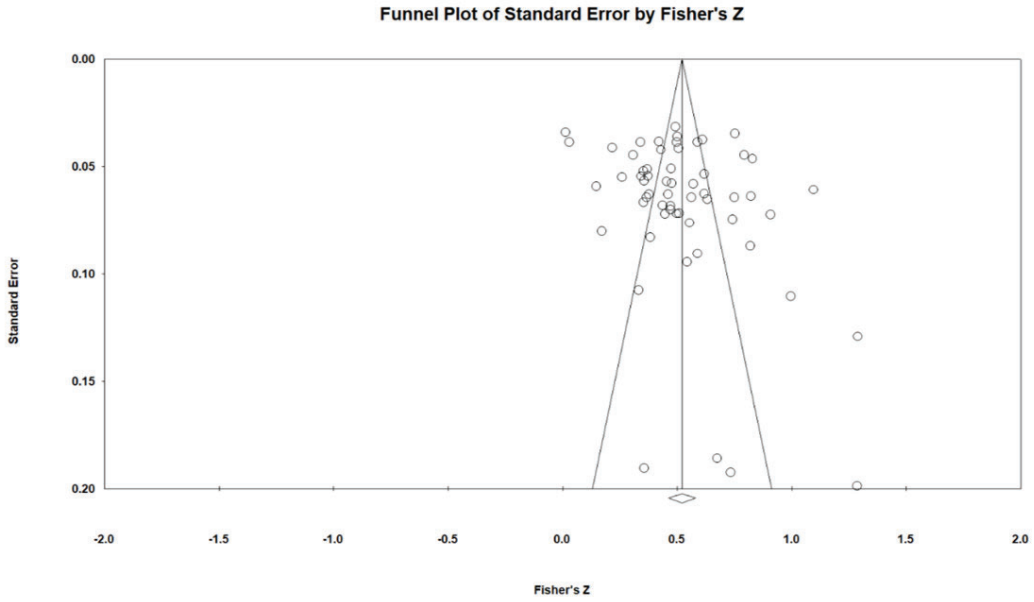
Heterogeneity analysis

A heterogeneity analysis was conducted on the 59 included studies. The test of heterogeneity yielded $Q(58) = 999.55$, $p < .001$, indicating substantial variability among effect sizes. Furthermore, the I^2 value was 94.20%, suggesting a high degree of heterogeneity across studies. Therefore, a random-effects model was adopted. Moreover, the between-study variance was $\tau^2 = 0.048$ ($\tau = 0.220$), implying a wide dispersion of actual effects, and an approximate PI ranged from 0.050 to 0.910.

Publication bias

The funnel plot spread evenly on both sides of the average (see Figure 3); thus, there should be no publication bias. Additionally, the Fail-safe Number test yielded a Z-value of 65.814 ($p < .001$), and the Nf.s was 6,468, indicating a very large effect size, which suggests a slight publication bias, as noted by Rosenthal (1991). Furthermore, the Begg and Mazumdar rank correlation test yielded Kendall's tau $b = .167$ ($p = .060$), indicating no publication bias (Begg & Mazumdar, 1994).

Figure 3. Funnel Plot of the 59 included studies



Moreover, we also examined the Egger's *t* test, which revealed Egger bias = 3.084 (95% CI = 0.0.4 to 6.134) ($p < .05$), which indicating a publication bias (Egger et al., 1997). However, Jin et al. (2015, p. 348) indicated that Egger's test might commit a type I error when there is heterogeneity. Therefore, because of the high heterogeneity in the included studies, we adopted the Fail-safe Number test and Kendall's tau and concluded that the results are unlikely to be explained by missing or unpublished studies in the included studies. We further conducted a trim-and-fill analysis using the Duval and Tweedie (2000) procedure under a random-effects model. The analysis suggested that no studies were missing, and the adjusted effect size was identical to the observed effect size. This indicates that the stress-burnout association is robust to potential publication bias.

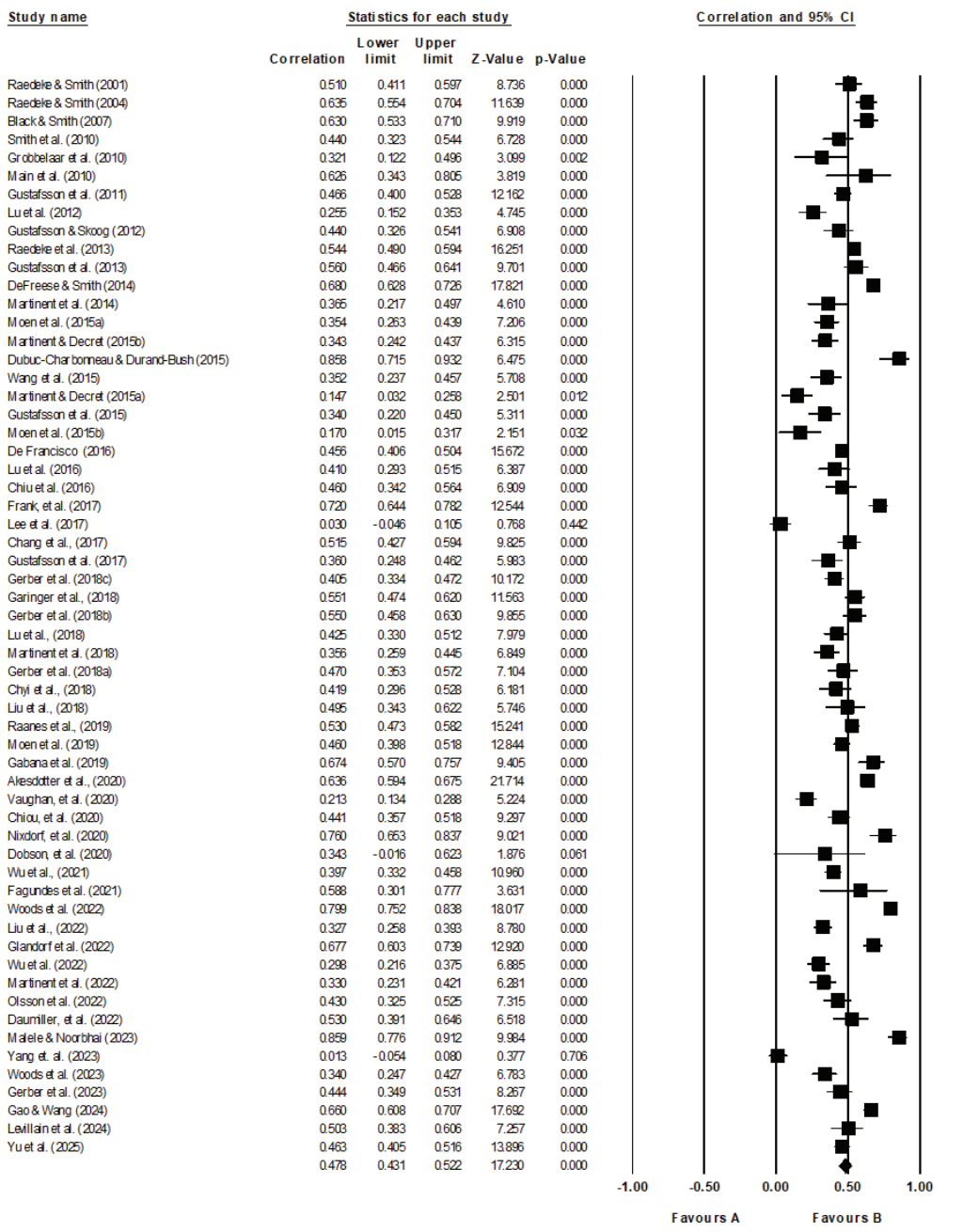
Effects of athletes' stress on burnout

A summary of the random-effects meta-analysis is presented in Figure 4, accompanied by a forest plot. The results of the meta-analysis revealed a strong association between athletes' stress and burnout ($r = 0.478$, CI = 0.431 to 0.522, $p < .05$; $\tau^2 = 0.048$, PI = [0.077, 0.746]) across all 59 studies. According to Cohen's (1988) suggestion, the stress-burnout effect size is considered large.

Moderation analysis

Based on the heterogeneous conditions of the 59 included studies, we examined the moderating effects of the stress-burnout relationship by seven moderators: age, gender, sports experience, training load, athletic level, region of athletes, and sports type.

Figure 4. Forest plot of the association between athletes' stress and burnout

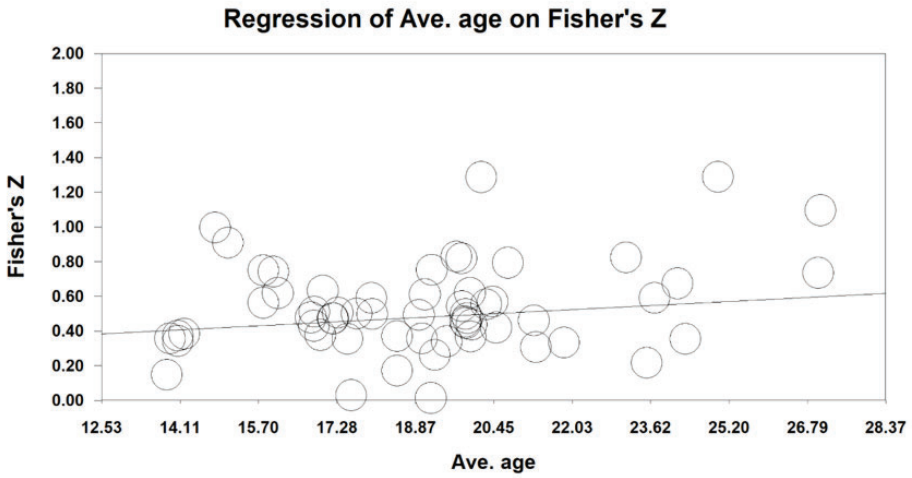


Note. 1. N = 59 studies; the relationship between athletes' stress and burnout was significantly positive with an effect size of r = .478 (CI = 0.431 to 0.522). 2. Moen et al. (2015a) = Moen, Federici, & Abrahamsen (2015); Moen et al. (2015b) = Moen, Abrahamsen, & Furrer (2015).

The moderating effect of age. Because the included 59 studies report diverse continuous numbers on age, we use a meta-regression to examine the effect of age on the stress-burnout relationship. The result of meta-regression, as illustrated in Figure 5, indicated that older athletes tend to show a stronger link between stress and burnout than younger athletes (β=.021, 95% CI = .001 to .041, p < .05, τ^2 = 0.048, PI = [-0.395, 0.430]).

gender. The result showed that the relationship between stress and burnout was similar for male and female athletes (r = .514 for male, 95% CI = -.006 to .815, k = 4, τ^2 = 0.328, PI = [-0.976, 0.998]; r = .343 for female, 95% CI = -.016 to .623, k = 1, τ^2 and PI were not estimated; p > .05; see Figure 6). However, the female subgroup (1 study) cannot contribute to heterogeneity estimation, and the male subgroup was also only four studies; additional studies are needed to clarify the sources of the gender

Figure 5. Age as moderator: Meta-Regression of age on stress and burnout

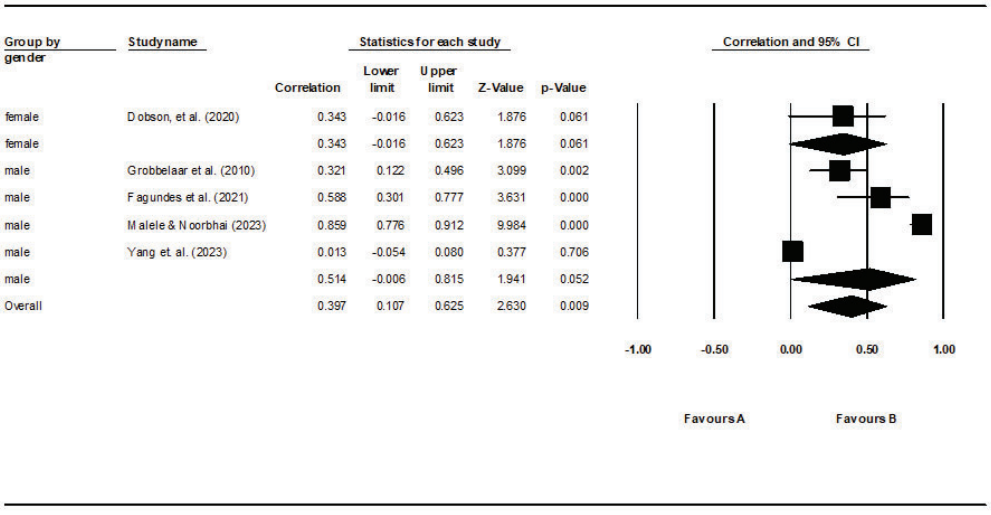


Note. N = 59 studies; the meta-regression coefficient (β) was .021, 95% CI = .001 to .041 (p < .05), indicating that age has a moderating effect; as age increases, the effect size of the stress-burnout relationship also increases.

The moderating effect of gender. According to the data on athletes' gender from the included studies, only four studies had all male athletes, and one study had all female athletes. Most of the studies (n = 54) collected data from both genders and reported a single result. Thus, five studies were applied to test the moderating effect of

variability. Given the very limited number of single-gender studies, statistical power was low, and the null moderation effect should be interpreted with caution.

Figure 6. Meta-analysis of studies investigating the stress-burnout effect (grouped by gender)

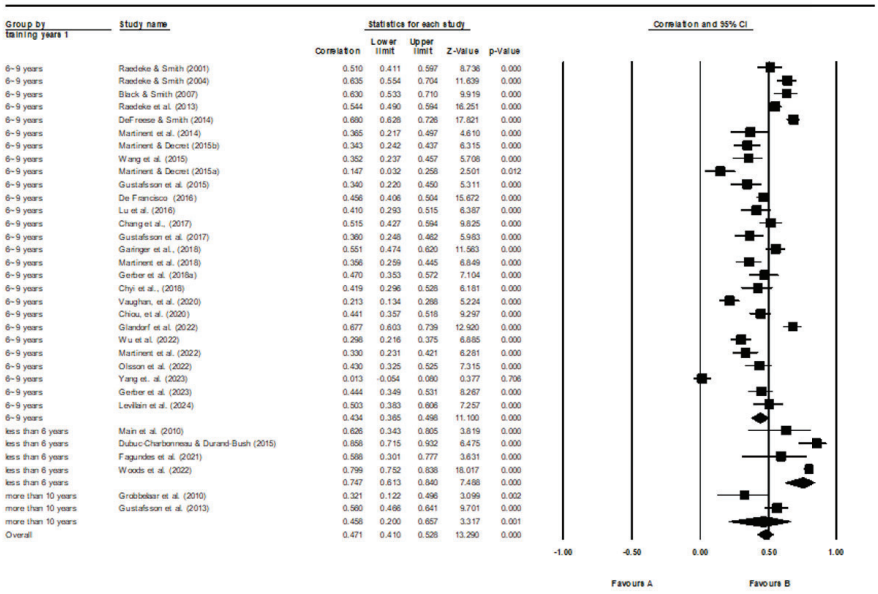


Note. N = 5 studies (only five of fifty-nine studies reported gender-specific results, so the moderation analysis used just these five.). The correlations between stress and burnout within the male and female groups demonstrated medium to high effect sizes (r = .514 for male, 95% CI = -.006–.815; r = .343 for female, 95% CI = -.016–.623), but no moderating effect on stress-burnout relationship (p > .05).

The moderating effect of sports experiences. Of the 59 included studies, 33 reported the athletes' sports experiences by year. Results showed that the training year moderated the stress-burnout relationship. Specifically, the athletes who had trained for less than 6 years (r = .747, 95% CI = .613 to .840, k = 4, τ^2 = 0.042, PI = [-0.954, 0.999]; see Figure 7) had a significantly higher effect than the 6- to 9-year group (r = .434, 95% CI = .365 to .498, k = 27, τ^2 = 0.028, PI = [0.110, 0.675]) and the more than 10-year group (r = .458, 95% CI = .200 to .657; k = 2, τ^2 = 0.037, PI was not estimated, p = .001).

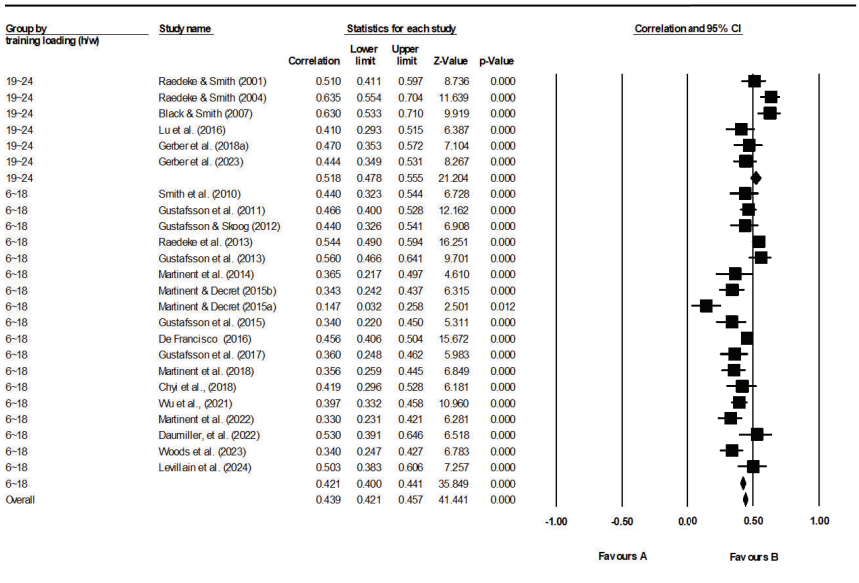
The moderating effect of training load. Among the included studies, 24 studies reported the athletes' training load. The results showed that training load (hours per week, h/w) had significant moderating effects on the stress-burnout relationship with the following correlations: r of 6~18 hours/w was = .411 (95% CI = .365 - .455, p < .05, k = 18, τ^2 = 0.010, PI = [0.214, 0.576]); 19~24 h/w r = .521 (95% CI = .439 - 0.595, p < .05, k = 6, τ^2 = 0.013, PI = [0.226, 0.730]; see Figure 8). Specifically, the 19~24 h/w group showed a stronger association between stress and burnout than the 6~18 h/w group (Q = 5.310, p = .021).

Figure 7. Meta-analysis of studies investigating the stress-burnout effect (grouped by training years of athletes)



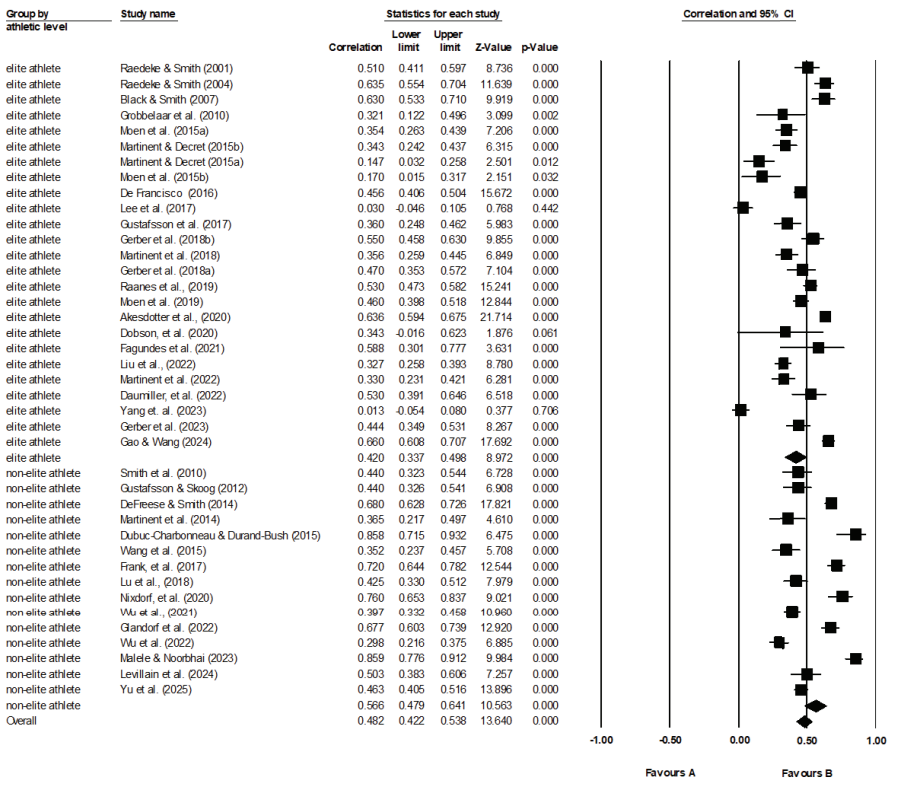
Note. 1. N = 33 studies; the correlation between stress and burnout among athletes with less than six years of training experience (r = .747, 95% CI = .613–.840) was significantly higher than that observed in athletes with six to nine years of training (r = .434, 95% CI = .365–.498) and those with more than ten years of training (r = .458, 95% CI = .200–.657; Q = 13.675, p = .001). These findings indicate that the relationship between stress and burnout is negatively moderated by the duration of athletes' training experience. 2.

Figure 8. Meta-analysis of studies investigating the stress-burnout effect (grouped by training hours per week)



Note. 1. N = 24 studies; the correlation of group of 19–24 h/w (r = .521, 95% CI = .439–.595) was higher than 6–18 hours/w group (r = .411, 95% CI = .365–.455; Q = 5.310, p = .021), the results showed that training load (hours per week, h/w) had significant positive moderating effects on the stress-burnout relationship. 2.

Figure 9. Meta-analysis of studies investigating the stress-burnout effect (grouped by athletic level)

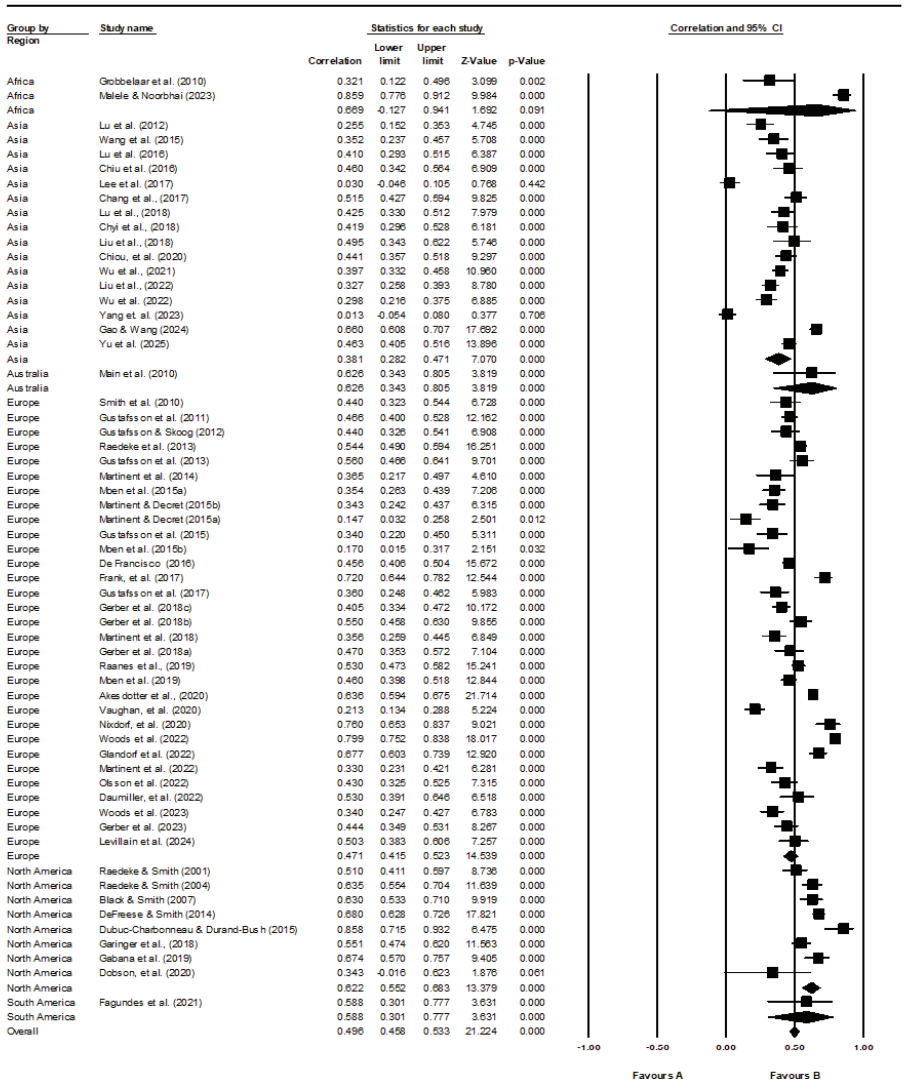


Note. 1. N = 40 studies; the correlation coefficient of the non-elite group (r = .566, 95% CI = .479–.641) was significantly higher than the elite group (r = .420, 95% CI = .337–.498; Q = 6.018, p = .014), which indicates that the athletes' athletic level moderated the stress-burnout relationship. 2. Moen et al. (2015a) = Moen, Federici, & Abrahamsen (2015); Moen et al. (2015b) = Moen, Abrahamsen, & Furrer (2015).

The moderating effect of region on athletes.

Athletes' region showed a moderating effect on the stress-burnout relationship (Q = 20.528, p = .001; see Figure 10). The correlation for athletes from North America (r = .622, 95% CI = .552 - .683, k = 8, τ^2 = 0.016, PI = [0.114, 0.872]) was significantly higher than that for Asia (r = .381, 95% CI = .282 - .471, k = 16, τ^2 = 0.048, PI = [-0.084,0.710]) and Europe (r = .471, 95% CI = .415 - .523, k = 31, τ^2 = 0.035, PI = [0.121, 0.717]). Thus, it is concluded that the region of athletes moderated the relationships between stress and burnout.

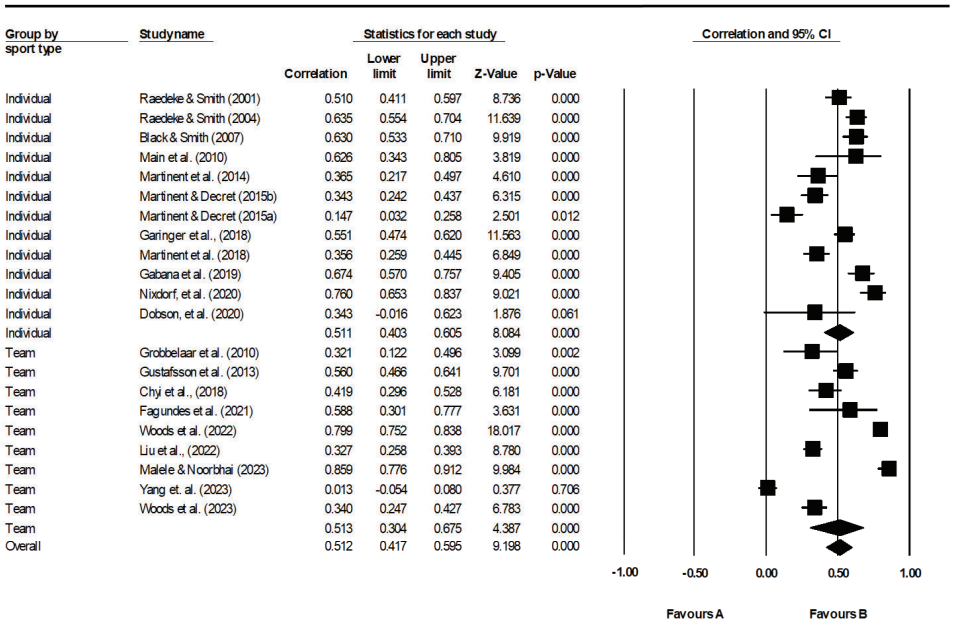
Figure 10. Meta-analysis of studies investigating the stress-burnout effect (grouped by region of athletes)



Note. 1. N = 59 studies; the correlation for athletes from North America (r = .622, 95% CI = .552–.683) was significantly greater than that for Asia (r = .381, 95% CI = .282–.471) and Europe (r = .471, 95% CI = .415–.523). This finding indicated that the region of athletes moderates the relationships between stress and burnout (Q = 20.528, p = .001). 2. Moen et al. (2015a) = Moen, Federici, & Abrahamsen (2015); Moen et al. (2015b) = Moen, Abrahamsen, & Furrer (2015).

The moderating effect of sport type. Of all 59 studies, 12 sampled individual sports while nine recruited team athletes. The result revealed that whether athletes competed in individual or team sports did not change the strength of the stress-burnout relationship (r for individual sport = .511, 95% CI = .403 - .605, k = 12, τ^2 = 0.050, PI = [0.042, 0.795]; r for team sport = .513, 95% CI = .304 - .675, k = 9, τ^2 = 0.142, PI = [-0.359, 0.907]; p > .05; see Figure 11).

Figure 11. Meta-analysis of studies investigating the stress-burnout effect (grouped by sport type)



Note. N = 19 studies; the sport type showed no moderating effect on the stress-burnout relationship (individual sport: r = .511, 95% CI = .403–.605; team sport: r = .513, 95% CI = .304–.675; Q < 0.001, p = .990).

Overall, our findings confirmed that age, sports experience, training load, athletic level, and region significantly moderated the relationship between stress and burnout, whereas gender and sport type did not.

Discussion

This meta-analysis of 59 studies involving 15,370 athletes confirms a positive correlation between stress and burnout in athletes (r = .478). In addition to the moderating effects of age and athletic level on the stress-burnout relationship reported by Lin et al. (2022), the present meta-analysis newly identified significant moderators, including sports experience (i.e., training years), training load, and geographical region (see Figure 1). The initial findings provide several theoretical implications for researchers.

Theoretical implications

Our study is consistent with Smith's (1986) cognitive-affective model of athletic burnout, which posits that burnout arises from perceived stress derived from athletes' cognitive appraisal of environmental demands and personal coping resources. Individual and contextual factors such as age, gender, training experience, training load, athletic level, cultural background, and sport type may influence this appraisal. By including these moderators in a meta-analysis, the present review provides updated evidence on how stress is associated with burnout in athletes.

We did not find moderating effects of gender and sport type. The null result for gender may reflect the limited number of single-sex samples, with only four studies including all male athletes and one including all female athletes. The very small pool of single-gender studies constrains the reliability of the analysis, and

additional research with adequately powered designs is needed to draw firmer conclusions. The lack of a moderating effect of sport type also contradicts our initial hypothesis. Previous research indicated that team sports foster cohesion and social support, which can buffer psychological distress (Reardon & Hitchcock, 2024). Sarkar and Fletcher (2014) also showed that team-sport athletes often rely on teammates and coaches for resilience. Based on this, we expected team athletes to show lower burnout risk, but our data did not support this expectation. Whether the stress-burnout link is too strong to be moderated by sport type or whether other psychosocial factors override this effect requires further study. Overall, these findings indicate that contextual and developmental moderators, such as training load and region, are more influential than demographic variables, such as gender or sport type.

Age as the moderator

The moderating effect of age on the stress-burnout relationship supports Lin et al.'s (2022) study. Several factors may explain this pattern. First, older athletes often face heightened performance expectations from coaches, teammates, media, and sponsors, perceiving failure as more consequential for their careers and reputations (Gustafsson et al., 2011). Second, ageing brings greater awareness of physical decline, slower recovery, and increased risk of injury. Finally, concerns about career longevity and post-sport transition (e.g., identity loss, financial security, social roles) add psychological strain (Lavallee & Robinson, 2007). Together, these pressures make older athletes more vulnerable to burnout.

Sports experience as the moderator

The analysis showed that less experienced athletes had a stronger stress-burnout relationship. This can be explained by their limited coping resources. Inexperienced athletes often lack effective strategies and may rely on avoidance, denial, or wishful thinking, which are less successful in managing stress (Nicholls & Polman, 2007). They also tend to view competition as threatening rather than challenging, adopting emotion-focused coping such as venting or disengagement, which increases anxiety and reduces performance (Anshel & Wells, 2000). In contrast, experienced athletes are better able to routinise preparation, manage anxiety, and appraise stress as controllable, thereby maintaining performance (Hanton et al., 2005). In general, these results suggest that novice athletes are more vulnerable to burnout, highlighting the need for coping-skills training early in their careers.

Training load as the moderator

The analysis revealed that training load significantly moderated the stress-burnout relationship. Heavy or excessive training, particularly without sufficient recovery, greatly increases the risk of burnout. Kellmann and Kallus (2001) showed that chronic stress not balanced by recovery leads to overtraining and burnout. Similarly, Gustafsson et al. (2011) found that high training volume was strongly associated with emotional exhaustion, especially among athletes with obsessive passion. Periodised training is designed to improve physical capacity through planned high-intensity sessions (Bompa & Buzzichelli, 2019). However, when poorly managed, it can lead to overtraining, mood disturbances, fatigue, performance decline, and eventually burnout (Meeusen et al., 2013; Morgan et al., 1998). These findings emphasise the importance of monitoring training loads and integrating recovery strategies to protect athletes from burnout.

Athletic level as the moderator

Our analysis showed that non-elite athletes had a stronger stress-burnout relationship than elite athletes. This finding is noteworthy, as elite athletes typically face greater external demands yet may still report lower levels of burnout. Although elite athletes often encounter intense

competition, media pressure, and organisational stress (Kristiansen et al., 2010), they also tend to possess superior coping skills and resilience that mitigate the effects of stress (Gustafsson et al., 2011). A recent review further highlighted that elite athletes frequently use a variety of problem-focused and emotion-regulation strategies to handle stress effectively (Nuetzel, 2023). In contrast, non-elite athletes may lack comparable coping resources, making them more susceptible to burnout. These results suggest that support programmes should target non-elite athletes, who may need additional psychological and social resources to manage stress. Nevertheless, the correlation between stress and burnout in elite and non-elite athletes merits further investigation.

Region as the moderator

As expected, the region significantly moderated the stress-burnout relationship. This is a novel contribution, as no previous studies have compared this link across cultures. In Asia, athletes are influenced by Confucian traditions that emphasise collectivism, filial piety, respect for authority, and emotional restraint (Li et al., 2004). These cultural values may encourage emotional suppression, altering how stress is expressed and managed. In contrast, American athletes often face high pressure to win and secure scholarships, as well as constant media scrutiny (Reardon & Factor, 2010). According to the conservation of resources theory (Hobfoll, 1989), access to external resources such as institutional and social support can buffer stress. European athletes benefit from mixed cultural influences and stronger welfare systems that provide structural support (Kristiansen et al., 2012). Collectivist traditions in both Asia and Europe may also facilitate social support, thereby reducing burnout risk (di Luzio et al., 2020; Shannon et al., 2022). However, regional differences may partly reflect unmeasured confounders, such as socioeconomic resources, institutional support systems, or the distribution of sport types, rather than purely cultural effects. Recent studies also emphasise that contextual factors, institutional structures, and sport-specific resources vary across regions and may influence burnout outcomes (Ma et al., 2025; Dišlere et al., 2025). Therefore, the regional moderation results should be interpreted with caution.

In general, our results highlight the importance of accounting for contextual and demographic moderators in future research. We encourage longitudinal and multi-level designs to examine how psychological variables, such as perfectionism, coping styles, and mental toughness, interact with stress and burnout across different sporting and cultural contexts (Kuettel & Larsen, 2020; Madigan et al., 2022).

Strengths of the study

Several strengths of this research need further discussion. First, by incorporating more recent literature (up to April 2025) and examining additional moderators such as age, gender, sports experiences, training load, athletic level, region of athletes, and sports type, we updated previous reviews (e.g., Lin et al., 2022). The meta-analysis synthesised data from 59 studies, encompassing 15,370 athletes, providing strong statistical power and increasing the generalisability of the findings across different populations, sports, and contexts. Furthermore, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist (Page et al., 2021) to conduct the study and examine all necessary analyses, including quality of included studies, heterogeneity, publication bias, and sensitivity tests, before formal meta-analysis, which makes this review more legitimate and reliable.

Limitations and future directions

This study has several limitations that should be noted. First, only peer-reviewed articles published in English were included, potentially excluding relevant studies

written in other languages or from the grey literature. Although publication bias tests indicated little evidence of bias, this restriction could still reduce the scope of the review. Second, the predominance of cross-sectional designs (45 of 59 studies) constrains causal inference regarding the stress-burnout relationship. The use of diverse stress and burnout measures across studies may also introduce inconsistencies in effect sizes. Additionally, several studies lacked detailed reporting of moderators such as training load, sport type, and athletic level, which weakened subgroup analyses and restricted more fine-grained recommendations. Future research should therefore adopt longitudinal and experimental designs, employ more consistent measurement tools, and ensure complete reporting of moderator variables. Expanding the cultural scope of research is also essential, as cultural norms, values, and support systems may shape the stress-burnout dynamic (e.g., Keriven & Owoeye, 2025). Cross-cultural comparisons would deepen understanding of burnout development and inform context-specific interventions tailored to different sporting environments and cultural contexts.

Practical implications

Preventing training-induced burnout requires a comprehensive, proactive approach that integrates psychological strategies, coaching practices, and environmental support. The overall stress-burnout association was large (r = .478), underscoring the need to treat burnout prevention as a high-priority concern across sporting contexts. The present findings indicate that older, more experienced athletes who train with higher loads, compete at elite levels, and are based in the Americas show a stronger association between stress and burnout. This pattern suggests that prevention programmes should be tailored according to developmental stage, training demands, and cultural background. Older and long-tenured athletes may accumulate psychological strain over time. This aligns with the theory of allostatic load (McEwen & Stellar, 1993), which posits that prolonged stress exposure without adequate recovery increases emotional exhaustion and physiological dysregulation (Gerber et al., 2018a). Given that athletes with longer sport experience demonstrated a stronger stress-burnout relationship (≥10 years: r = .502 vs. <6 years: r = .436), targeted recovery strategies should be emphasised for long-tenured athletes. For example, national-level athletes preparing for major competitions could benefit from scheduled psychological recovery phases, such as short breaks from competition or structured off-season rest periods, to reduce accumulated stress.

Heavy training loads also increase the risk of burnout, especially when recovery is inadequate. An imbalance between training stress and rest might lead to overtraining symptoms and emotional fatigue (Meeusen et al., 2013). Tools such as the RESTQ-Sport enable stress-recovery profiling, allowing coaches to adjust training plans as needed (Kellmann & Beckmann, 2018). In line with this, our moderation analysis revealed a stronger association under higher training loads (19–24 hours/week: r = .521) compared with moderate training loads (6–18 hours/week: r = .411), underscoring the need for ongoing monitoring for athletes exceeding approximately 19 hours weekly. In practice, this could involve weekly stress-recovery monitoring sheets or mobile apps during training camps to flag athletes who require reduced load or additional recovery strategies. Furthermore, athletes at higher competition levels might be especially vulnerable to performance-related pressure. Mindfulness-based and cognitive-behavioural interventions have demonstrated efficacy in reducing burnout symptoms in youth athletes (Wilczyńska et al., 2022). Interestingly, our findings indicated that non-elite athletes displayed a stronger stress–burnout association (r = .566) than elite athletes (r = .420), suggesting that prevention programs should

also prioritise non-elite groups, who may lack the advanced coping skills and systemic support available to elite counterparts. Applied to elite training environments, mindfulness sessions could be integrated into daily warm-ups or recovery routines to help athletes regulate emotions during high-pressure tournaments.

Coaching behaviours also significantly influence athlete motivation and emotional health. Autonomy-supportive coaching satisfies athletes' basic psychological needs and fosters intrinsic motivation (Deci & Ryan, 2000). Empirical work showed that basic need satisfaction and social support were associated with lower burnout levels (Shannon et al., 2021), and that coaches trained in autonomy-supportive strategies reduced burnout and increased intrinsic motivation among youth football players (Langan et al., 2015). For example, a football coach who provides athletes with choices in training drills, explains the rationale for training intensity, and encourages player input may create an environment that prevents emotional exhaustion and fosters motivation. Such approaches may be particularly effective in contexts where our analyses showed medium-to-large effect sizes (*r* values around .45–.50), highlighting the substantial role of the coach–athlete dynamic in modulating burnout risk.

Given the stronger stress-burnout association found among athletes from the Americas, cultural pressures such as scholarship competition and media scrutiny may intensify emotional demands (Reardon & Factor, 2010). Addressing these contextual stressors through supportive team climates is essential. Social support from significant others plays an important role in athletes' wellbeing (Chen et al., 2023) and remains one of the most effective buffers against burnout (DeFreese et al., 2015). Consistent with this, athletes from North America exhibited the strongest association (r = .622), compared with Europe (r = .471) and Asia (r = .381). These magnitudes highlight the need for regionally tailored strategies, such as mentorship programs and family-inclusive workshops, in high-pressure cultural contexts. Practical strategies include mentorship programs where senior athletes support younger teammates, family-inclusive workshops to build communication, and regular team-building sessions that reinforce collective identity. Moreover, athletes in collectivist cultures might benefit from social coping and group-based interventions (Chan & Hagger, 2012; Kim et al., 2008).

In conclusion, interventions to prevent burnout should be developmentally and contextually appropriate, combining psychological skills training, autonomy-supportive coaching, and systemic support structures. Embedding these approaches into daily training routines and competition environments, such as by monitoring training loads, implementing recovery protocols, providing athlete-centred coaching, and fostering team cohesion, can protect athletes from burnout and sustain long-term performance and wellbeing.

Conclusion

To fill the gap of earlier reviews of the athletes' stress-burnout relationship, we conducted a systematic review and meta-analysis. We found a strong association between stress and burnout, and that age, sports experience, training load, athletic level, and region moderate this association. The findings update current knowledge of the relationship between athletes' stress and burnout and provide a comprehensive picture of its variations. We suggest that sports professionals provide athletes with appropriate stress management programs during their daily training. By doing so, we can prevent the negative consequences of youth sports participation and enhance their psychological well-being.

Ethics statement

This research is a secondary analysis of published studies. All included articles were peer-reviewed and assumed to meet the ethical standards of their respective institutions.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Disclosure statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Data Availability Statement

All data analysed in this review were obtained from published studies. The extracted datasets and analytic code are available from the corresponding author upon reasonable request.

Acknowledgement

The authors acknowledge the use of ChatGPT by OpenAI and Wordvice to assist in semantic clarification and language refinement. All content was critically reviewed, revised, and approved by the authors to ensure accuracy, originality, and adherence to academic integrity standards. The final manuscript reflects the authors' independent analysis, interpretation, and scholarly contributions.

Notes on Contributors

Chien-Hsun Lin, PhD, is an assistant professor in the Department of Physical Education at Fu Jen Catholic University, where he also serves as the Director of the Teaching and Research Division in the Office of Physical Education. His research interests include athlete stress and burnout, sport injury, health-related physical fitness, and aquatic sports. He has been actively involved in empirical research examining psychosocial and physiological determinants of athlete well-being. Please direct correspondence to: 062239@mail.fju.edu.tw

Frank Jing-Horng Lu, PhD, is a professor at Chinese Culture University and the corresponding author of this paper. His research focuses on sport and exercise psychology, mental skills training, social and psychological aspects of youth sport issues, athlete well-being, and sport psychology consultation. He has served as editor or editorial board member for several international journals and led multiple national research grants related to sport psychology and athlete development. Please direct correspondence to: ljh25@ulive.pccu.edu.tw

Yun-Che Hsieh, is an assistant professor in the Department of Sport Sciences at the Army Academy, R.O.C. His research focuses on stress, mental toughness, burnout, imagery, and sport injury among athletes. His work contributes to the understanding of psychological and performance-related factors in military and athletic training environments. Please direct correspondence to: a490930435@gmail.com

Wei-Jiun Shen, PhD, is currently a postdoctoral researcher at the Graduate Institute of Coaching Science at Chinese Culture University, Taipei, Taiwan, and serves as an adjunct assistant professor at the Graduate Institute of Sport Science at National Taiwan Sport University, Taoyuan, Taiwan. His research interests include athletic mental energy, sport motivation, group dynamics, inclusive physical activity among individuals with disabilities, and sport psychology consultation. He has contributed to the development and validation of psychological assessment tools in sport and exercise psychology. Please direct correspondence to: shenweichjiun@gmail.com

References

Åkesdotter, C., Kenttä, G., Eloranta, S., & Franck, J. (2020). The prevalence of mental health problems in elite athletes. *Journal of Science and Medicine in Sport*, *23*(4), 329–335. https://doi.org/10.1016/j.jsams.2019.10.022

Anshel, M. H., & Wells, B. (2000). Personal and situational variables that describe coping with acute stress in competitive sport. *The Journal of Social Psychology*, *140*(4), 434–450. https://doi.org/10.1080/00224540009600483

Arnold, R., Fletcher, D., & Daniels, K. (2013). Development and validation of the Organizational Stressor Indicator for Sport Performers (OSI-SP). *Journal of Sport and Exercise Psychology*, *35*(2), 180–196. https://doi.org/10.1123/jsep.35.2.180

Atkinson, D. R., & Gim, R. H. (1989). Asian-American cultural identity and attitudes toward mental health services. *Journal of Counseling Psychology, 36*, 209–212. doi:10.1037/0022-0167.36.2.209

Bados, A., Solanas, A., & Andrés, R. (2005). Psychometric properties of the Spanish version of Depression, Anxiety and Stress Scales (DASS). *Psicothema, 17*(4), 679–683.

Begg, C. B., & Mazumdar, M. (1994). Operating characteristics of a rank correlation test for publication bias. *Biometrics*, *50*(4), 1088–1101. https://doi.org/10.2307/2533446

Birrer, D., & Morgan, G. (2010). Psychological skills training as a way to enhance an athlete's performance in high-intensity sports. *Scandinavian Journal of Medicine and Science in Sports*, *20*(Suppl 2), 78–87. https://doi.org/10.1111/j.1600-0838.2010.01188.x

Black, J. M., & Smith, A. L. (2007). An examination of Coakley's perspective on identity. *International Journal of Sport Psychology, 38(4)*, 417–436.

Bompa, T. O., & Buzzichelli, C. (2019). *Periodization: Theory and methodology of training* (6th ed.). Human Kinetics.

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. John Wiley & Sons. https://doi.org/10.1002/9780470743386

Chan, D. K., & Hagger, M. S. (2012). Self-determined forms of motivation predict sport injury prevention and rehabilitation intentions. *Journal of Science and Medicine in Sport*, *15*(5), 398–406. https://doi.org/10.1016/j.jsams.2012.03.016

Chang, K. H., Lu, F. J. H., Chyi, T., Hsu, Y. W., Chan, S. W., & Wang, E. T. W. (2017). Examining the stress-burnout relationship: The mediating role of negative thoughts. *PeerJ*, *5*, Article e4181. https://doi.org/10.7717/peerj.4181

CHANG, S. S. (2021). *Meta-analysis practice: Using Excel and CMA programs* (2nd ed.). Wu-Nan Book.

Chen, T. W., Chiu, Y. C., & Hsu, Y. W. (2023). Intercollegiate athletes' gratitude, coaches' social support, and psychological well-being: Validation of the mediation model. *Sports and Exercise Research*, *25*(1), 1–12. https://doi.org/10.5297/ser.202303_25(1).0001

Chiou, S. S., Hsu, Y., Chiu, Y. H., Chou, C. C., Gill, D. L., & Lu, F. J. (2020). Seeking positive strengths in buffering athletes' life stress-burnout relationship: The moderating roles of athletic mental energy. *Frontiers in Psychology, 10*, Article 3007. https://doi.org/10.3389/fpsyg.2019.03007

Chiu, Y. H., Lu, F. J., Lin, J. H., Nien, C. L., Hsu, Y. W., & Liu, H. Y. (2016). Psychometric properties of the Perceived Stress Scale (PSS): Measurement invariance between athletes and non-athletes and construct validity. *PeerJ*, *4*, Article e2790. https://doi.org/10.7717/peerj.2790

Chyi, T., Lu, F. J., Wang, E. T. W., Hsu, Y. W., & Chang, K. H. (2018). Prediction of life stress on athletes' burnout: The dual role of perceived stress. *PeerJ*, *6*, Article e4213. https://doi.org/10.7717/peerj.4213

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge. https://doi.org/10.4324/9780203771587

Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan & S. Oskamp (Eds.), *The social psychology of health: The Claremont symposium on applied social psychology* (pp. 31–67). Sage.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385–396. https://doi.org/10.2307/2136404

Cohen, S., Kamarck, T., & Mermelstein, R. (1994). *Perceived Stress Scale*. In S. Cohen, R. C. Kessler, & L. U. Gordon (Eds.), *Measuring stress: A guide for health and social scientists* (pp. 10–12). Oxford University Press.

Côté, J., Baker, J., & Abernethy, B. (2007). Practice and play in the development of sport expertise. In G. Tenenbaum & R. C. Eklund (Eds.), *Handbook of sport psychology* (3rd ed., pp. 184–202). John Wiley & Sons. https://doi.org/10.1002/9781118270011.ch8

Cresswell, S. L., & Eklund, R. C. (2005). Changes in athlete burnout and motivation over a 12-week league tournament. *Medicine and Science in Sports and Exercise*, *37*(11), 1957–1966. https://doi.org/10.1249/01.mss.0000176304.14675.32

Crocker, P. R. E., & Graham, R. (1995). Coping by competitive athletes with performance stress: Gender differences and relationships with affect. *The Sport Psychologist*, *9*(3), 325–338. https://doi.org/10.1123/tsp.9.3.325

Daumiller, M., Rinas, R., & Breithecker, J. (2021). Elite athletes' achievement goals, burnout levels, psychosomatic stress symptoms, and coping strategies. *International Journal of Sport and Exercise Psychology, 20*(2), 416–435. https://doi.org/10.1080/1612197X.2021.1877326

De Francisco, C., Arce, C., del Pilar Vílchez, M., & Vales, Á. (2016). Antecedents and consequences of burnout in athletes: Perceived stress and depression. *International Journal of Clinical and Health Psychology, 16*(3)*,* 239–246. https://doi.org/10.1016/j.ijchp.2016.04.001

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01

DeFreese, J. D., & Smith, A. L. (2014). Athlete social support, negative social interactions, and psychological health across a competitive sport season. *Journal of Sport and Exercise Psychology, 36(6)*, 619–630. https://doi.org/10.1123/jsep.2014-0040

DeFreese, J. D., Smith, A. L., & Raedeke, T. D. (2015). Individual and organizational solutions to athlete burnout. In J. M. Williams & V. Krane (Eds.), *Applied sport psychology: Personal growth to peak performance* (pp. 444–461). McGraw-Hill.

di Luzio, S. S., Martinent, G., Guillet-Descas, E., & Daigle, M.-P. (2020). Exploring the role of sport sense of community in perceived athlete burnout, sport motivation, and engagement. *Journal of Applied Sport Psychology*, *32*(5), 513–528. https://doi.org/10.1080/10413200.2019.1575298

Dišlere, B. E., Mārtinsone, K., & Koļesņikova, J. (2025). A scoping review of longitudinal studies of athlete burnout. *Frontiers in Psychology*, *16*, Article 1502174. https://doi.org/10.3389/fpsyg.2025.1502174

Dobson, J., Harris, B., Claytor, A., Stroud, L., Berg, L., & Chrysosferidis, P. (2020). Selected cardiovascular and psychological changes throughout a competitive season in collegiate female swimmers. *The Journal of Strength and Conditioning Research, 34*(11), 3062–3069. https://doi.org/10.1519/jsc.0000000000003767

Dubuc-Charbonneau, N., & Durand-Bush, N. (2015). Moving to action: The effects of a self-regulation intervention on the stress, burnout, well-being, and self-regulation capacity

levels of university student-athletes. *Journal of Clinical Sport Psychology, 9*(2), 173–192. https://doi.org/10.1123/jcsp.2014-0036

Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, *56*(2), 455–463. https://doi.org/10.1111/j.0006-341x.2000.00455.x

Egger, M., Davey Smith, G., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ*, *315*(7109), 629–634. https://doi.org/10.1136/bmj.315.7109.629

Fagundes, L. H. S., Noce, F., Albuquerque, M. R., de Andrade, A. G. P., & Teoldo da Costa, V. (2019). Can motivation and overtraining predict burnout in professional soccer athletes in different periods of the season? *International Journal of Sport and Exercise Psychology, 19*(2), 279–294. https://doi.org/10.1080/1612197X.2019.1655778

Field, A. P., & Gillett, R. (2010). How to do a meta-analysis. *British Journal of Mathematical and Statistical Psychology*, *63*(Pt 3), 665–694. https://doi.org/10.1348/000711010X502733

Frank, R., Nixdorf, I., & Beckmann, J. (2017). Analyzing the relationship between burnout and depression in junior elite athletes. *Journal of Clinical Sport Psychology, 11*(4), 287–303. https://doi.org/10.1123/JCSP.2017-0008

Gabana, N. T., Steinfeldt, J., Wong, Y. J., Chung, Y. B., & Svetina, D. (2018). Attitude of gratitude: Exploring the implementation of a gratitude intervention with college athletes. *Journal of Applied Sport Psychology, 31*(3), 273–284. https://doi.org/10.1080/10413200.2018.1498956

Gao, Y., & Wang, L. (2024). A study on the relationship and path between mental health and burnout of Chinese athletes. *Frontiers in Psychology*, *15*, Article 1422207. https://doi.org/10.3389/fpsyg.2024.1422207

Garinger, L. M., Chow, G. M., & Luzzeri, M. (2018). The effect of perceived stress and specialization on the relationship between perfectionism and burnout in collegiate athletes. *Anxiety, Stress, and Coping, 31*(6), 714–727. https://doi.org/10.1080/10615806.2018.1521514

Gerber, M., Best, S., Meerstetter, F., Walter, M., Ludyga, S., Brand, S., Bianchi, R., Madigan, D. J., Isoard-Gautheur, S., & Gustafsson, H. (2018a). Effects of stress and mental toughness on burnout and depressive symptoms: A prospective study with young elite athletes. *Journal of Science and Medicine in Sport*, *21*(12), 1200–1205. https://doi.org/10.1016/j.jsams.2018.05.018

Gerber, M., Colledge, F., Mücke, M., Schilling, R., Brand, S., & Ludyga, S. (2018b). Psychometric properties of the Shirom-Melamed Burnout Measure (SMBM) among adolescents: Results from three cross-sectional studies. *BMC Psychiatry, 18,* Article 266. https://doi.org/10.1186/s12888-018-1841-5

Gerber, M., Gustafsson, H., Seelig, H., Kellmann, M., Ludyga, S., Colledge, F., Brand, S., Isoard-Gautheur, S., & Bianchi, R. (2018c). Usefulness of the Athlete Burnout Questionnaire (ABQ) as a screening tool for the detection of clinically relevant burnout symptoms among young elite athletes. *Psychology of Sport and Exercise, 39,* 104–113. https://doi.org/10.1016/j.psychsport.2018.08.005

Gerber, M., Lang, C., Brand, S., Gygax, B., Ludyga, S., Müller, C., Ramseyer, S., & Jakowski, S. (2023). Perceived recovery and stress states as predictors of depressive, burnout, and insomnia symptoms among adolescent elite athletes. *Sports Psychiatry, 2*(1), 13–22. https://doi.org/10.1024/2674-0052/a000017

Gill, D. L. (2020). Gender and culture. In G. Tenenbaum, R. C. Eklund, & N. Boiangin (Eds.), *Handbook of sport psychology: Exercise, methodologies, and special topics* (4th ed., pp. 1131–1151). John Wiley & Sons. https://doi.org/10.1002/9781119568124.ch55

Glandorf, H. L., Coffee, P., & Madigan, D. J. (2022). Team identification and athlete burnout: Testing longitudinal serial mediation via perceived support and stress. *Psychology of Sport and Exercise, 63,* Article 102292. https://doi.org/10.1016/j.psychsport.2022.102292

Glandorf, H. L., Madigan, D. J., Kavanagh, O., & Mallinson-Howard, S. H. (2025). Mental and physical health outcomes of burnout in athletes: A systematic review and meta-analysis. *International Review of Sport and Exercise Psychology*, *18*(1), 372–416. https://doi.org/10.1080/1750984X.2023.2225187

Glandorf, H. L., Madigan, D. J., Kavanagh, O., Mallinson-Howard, S. H., Donachie, T. C., Olsson, L. F., & Rumbold, J. L. (2024). Athlete burnout and mental and physical health: A three-wave longitudinal study of direct and reciprocal effects. *Sport, Exercise, and Performance Psychology*, *13*(4), 412–431. https://doi.org/10.1037/spy0000355

Grobbelaar, H., Malan, D., Steyn, B., & Ellis, S. (2010). Factors affecting the recovery-stress, burnout and mood state scores of elite student rugby players. *South African Journal for Research in Sport, Physical Education and Recreation, 32*(2), 41–54. https://doi.org/10.4314/sajrs.v32i2.59296

Guedes, D. P., & Souza R. O. (2016). Psychometric properties of the athlete burnout questionnaire for young Brazilian athletes. *Journal of Physical Education, 27*, Article e2708. https://doi.org/10.4025/jphyseduc.v27i1.2708

Gustafsson, H., & Skoog, T. (2012). The mediational role of perceived stress in the relation between optimism and burnout in competitive athletes. *Anxiety, Stress, and Coping, 25*(2)*,* 183–199. https://doi.org/10.1080/10615806.2011.594045

Gustafsson, H., Hassmén, P., & Hassmén, N. (2011). Are athletes burning out with passion? *European Journal of Sport Science, 11*(6)*,* 387–395. https://doi.org/10.1080/17461391.2010.536573

Gustafsson, H., Hassmén, P., Kenttä, G., & Johansson, M. (2011). A qualitative analysis of burnout in elite Swedish athletes. *Psychology of Sport and Exercise, 9*(6), 800–816. https://doi.org/10.1016/j.psychsport.2007.11.004

Gustafsson, H., Sagar, S. S., & Stenling, A. (2017). Fear of failure, psychological stress, and burnout among adolescent athletes competing in high level sport. *Scandinavian Journal of Medicine and Science in Sports*, *27*(12), 2091–2102. https://doi.org/10.1111/sms.12797

Gustafsson, H., Skoog, T., Davis, P., Kenttä, G., & Haberl, P. (2015). Mindfulness and its relationship with perceived stress, affect, and burnout in elite junior athletes. *Journal of Clinical Sport Psychology, 9(3)*, 263–281. https://doi.org/10.1123/jcsp.2014-0051

Gustafsson, H., Skoog, T., Podlog, L., Lundqvist, C., & Wagnsson, S. (2013). Hope and athlete burnout: Stress and affect as mediators. *Psychology of Sport and Exercise, 14*(5), 640–649. https://doi.org/10.1016/j.psychsport.2013.03.008

Hamlin, M. J., Wilkes, D., Elliot, C. A., Lizamore, C. A., & Kathiravel, Y. (2019). Monitoring training loads and perceived stress in young elite university athletes. *Frontiers in Physiology*, *10*, Article 34. https://doi.org/10.3389/fphys.2019.00034

Hanton, S., Fletcher, D., & Coughlan, G. (2005). Stress in elite sport performers: A comparative study of competitive and organizational stressors. *Journal of Sports Sciences*, *23*(10), 1129–1141. https://doi.org/10.1080/02640410500131480

Higgins, J. P. T., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ, 327(7414)*, 557–560. https://doi.org/10.1136/bmj.327.7414.557

Hilpisch, C., Krüger, K., Raab, M., Wiese, L., Zentgraf, K., & Mutz, M. (2024). Burnout symptoms in elite athletes: Assessing the role of effort–reward imbalance, support and

emotions. *International Review for the Sociology of Sport, 59*(7), 1054–1074. https://doi.org/10.1177/10126902241248767

Hitzschke, B., Kölling, S., Ferrauti, A., Meyer, T., Pfeiffer, M., & Kellmann, M. (2015). Development of the Short Recovery and Stress Scale for Sports (SRS). *Zeitschrift für Sportpsychologie, 22*(4), 146–161. https://doi.org/10.1026/1612-5010/a000150

Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist*, *44*(3), 513–524. https://doi.org/10.1037/0003-066X.44.3.513

Isoard-Gautheur, S., Guillet-Descas, E., & Gustafsson, H. (2016). Athlete burnout and the risk of dropout among young elite handball players. *The Sport Psychologist*, *30*(2), 123–130. https://doi.org/10.1123/tsp.2014-0140

Isoard-Gautheur, S., Oger, M., Guillet, E., & Martin-Krumm, C. (2010). Validation of a French version of the Athlete Burnout Questionnaire (ABQ): In competitive sport and physical education context. *European Journal of Psychological Assessment, 26*(3), 203–211. https://doi.org/10.1027/1015-5759/a000027

Jin, Z. C., Zhou, X. H., & He, J. (2015). Statistical methods for dealing with publication bias in meta-analysis. *Statistics in Medicine*, *34*(2), 343–360. https://doi.org/10.1002/sim.6342

Kellmann, M., & Beckmann, J. (2018). *Sport, recovery, and performance: Interdisciplinary insights*. Routledge.

Kellmann, M., & Kallus, K. W. (2001). *Recovery-stress questionnaire for athletes: User manual*. Human Kinetics.

Keriven, H., & Owoeye, O. B. (2025). Psychological wellbeing of student-athletes: A comparative study between European and American athletes. *Frontiers in Psychology*, *16*, Article 1604783. https://doi.org/10.3389/fpsyg.2025.1604783

Kim, H. S., Sherman, D. K., & Taylor, S. E. (2008). Culture and social support. *American Psychologist*, *63*(6), 518–526. https://doi.org/10.1037/0003-066X

Kline, R. B. (2004). *Beyond significance testing: Reforming data analysis methods in behavioral research*. American Psychological Association. https://doi.org/10.1037/10693-000

Kmet, L. M., Lee, R. C., & Cook, L. S. (2004). *Standard quality assessment criteria for evaluating primary research papers from a variety of fields*. Alberta Heritage Foundation for Medical Research. https://doi.org/10.7939/R37M04F16

Kristiansen, E., & Roberts, G. C. (2010). Young elite athletes and social support: Coping with competitive and organizational stress in "Olympic" competition. *Scandinavian Journal of Medicine and Science in Sports*, *20*(4), 686–695. https://doi.org/10.1111/j.1600-0838.2009.00950.x

Kristiansen, E., Halvari, H., & Roberts, G. C. (2012). Organizational and media stress among professional football players: Testing an achievement goal theory model. *Scandinavian Journal of Medicine and Science in Sports*, *22*(4), 569–579. https://doi.org/10.1111/j.1600-0838.2010.01259.x

Kuettel, A., & Larsen, C. H. (2020). Risk and protective factors for mental health in elite athletes: A scoping review. *International Review of Sport and Exercise Psychology*, *13*(1), 231–265. https://doi.org/10.1080/1750984X.2019.1689574

Langan, E., Blake, C., Toner, J., & Lonsdale, C. (2015). Testing the effects of a self-determination theory-based intervention with youth Gaelic football coaches on athlete motivation and burnout. *The Sport Psychologist*, *29*(4), 293–301. https://doi.org/10.1123/tsp.2013-0107

Lavallee, D., & Robinson, H. K. (2007). In pursuit of an identity: A qualitative exploration of retirement from women's artistic gymnastics. *Psychology of Sport and Exercise, 8*(1), 119–141. https://doi.org/10.1016/j.psychsport.2006.05.003

Lee, K. C., Suh, S. J., & Lee, K. H. (2014). Development of stress scale for physical education high school students. *Korean Journal of Sport Psychology*, *25*(2), 105–118. https://doi.org/10.14385/KSSP.25.2.105

Lee, K., Kang, S., & Kim, I. (2017). Relationships among stress, burnout, athletic identity, and athlete satisfaction in students at Korea's physical education high schools: Validating differences between pathways according to ego resilience. *Psychological Reports, 120*(4)*,* 585–608. https://doi.org/10.1177/0033294117698465

Lerman, Y., Melamed, S., Shragin, Y., Kushnir, T., Rotgoltz, Y., Shirom, A., & Aronson, M. (1999). Association between burnout at work and leukocyte adhesiveness/aggregation. *Psychosomatic Medicine, 61*(6), 828–833. https://doi.org/10.1097/00006842-199911000-00017

Levillain, G., Vacher, P., de Roten, Y., & Nicolas, M. (2024). Influence of defense mechanisms on sport burnout: A multiple mediation analysis effects of resilience, stress and recovery. *Sports*, *12*(10), Article 274. https://doi.org/10.3390/sports12100274

Li, J., Wang, L., & Fischer, K. (2004). The organisation of Chinese shame concepts? *Cognition and Emotion*, *18*(6), 767–797. https://doi.org/10.1080/02699930341000202

Lin, C.-H., Lu, F. J. H., Chen, T.-W., & Hsu, Y. (2022). Relationship between athlete stress and burnout: A systematic review and meta-analysis. *International Journal of Sport and Exercise Psychology*, *20*(5), 1295–1315. https://doi.org/10.1080/1612197X.2021.1987503

Liu, H.-Y., Lu, F. J., Zhang, X.-L., Gill, D. L., Chiu, Y.-H., & Chan, S.-W. (2018). Cross-cultural adaptation of the Organizational Stressor Indicator for Sport Performers (OSI-SP) in Taiwan. *Measurement in Physical Education and Exercise Science, 22*(3), 263–274. https://doi.org/10.1080/1091367X.2018.1430577

Liu, M., Zhao, X., & Liu, Z. (2022). Relationship between psychological distress, basic psychological needs, anxiety, mental pressure, and athletic burnout of Chinese college football athletes during the COVID-19 pandemic. *Sustainability, 14*(12), Article 7100. https://doi.org/10.3390/su14127100

Lovibond, S. H., & Lovibond, P. F. (1995). *Depression Anxiety Stress Scales (DASS-21, DASS-42)*. APA PsycTests. https://doi.org/10.1037/t01004-000

Lu, F. J. H., Hsu, Y. W., Chan, Y. S., Cheen, J. R., & Kao, K. T. (2012). Assessing college student-athletes' life stress: Initial measurement development and validation. *Measurement in Physical Education and Exercise Science, 16*(4), 254–267. https://doi.org/10.1080/1091367X.2012.693371

Lu, F. J., Gill, D. L., Yang, C. M., Lee, P. F., Chiu, Y. H., Hsu, Y. W., & Kuan, G. (2018). Measuring athletic mental energy (AME): Instrument development and validation. *Frontiers in Psychology, 9*, Article 2363. https://doi.org/10.3389/fpsyg.2018.02363

Lu, F. J., Lee, W. P., Chang, Y. K., Chou, C. C., Hsu, Y. W., Lin, J. H., & Gill, D. L. (2016). Interaction of athletes' resilience and coaches' social support on the stress-burnout relationship: A conjunctive moderation perspective. *Psychology of Sport and Exercise, 22*, 202–209. https://doi.org/10.1016/j.psychsport.2015.08.005

Lu, J. H., Chen, L. H., & Cho, K. H. (2006). Revision of Raedeke and Smith's Athlete Burnout Questionnaire (ABQ): Analyses of validity and reliability of Chinese version. *Physical Education Journal*, *39*(3), 83–94. https://doi.org/10.6222/pej.3903.200609.1107

Ma, Q. S., Chun, B. O., & Yao, S. J. (2025). Associations between life stress and athlete burnout: The chain mediation role of mindfulness and cognitive emotion regulation strategies. *BMC Psychology*, *13*(1), Article 382. https://doi.org/10.1186/s40359-025-02670-8

Madigan, D. J., Olsson, L. F., Hill, A. P., & Curran, T. (2022). Athlete burnout symptoms are increasing: A cross-temporal meta-analysis of average levels from 1997 to 2019. *Journal of Sport and Exercise Psychology*, *44*(3), 153–168. https://doi.org/10.1123/jsep.2020-0291

Main, L. C., Landers, G. J., Grove, J. R., Dawson, B., & Goodman, C. (2010). Training patterns and negative health outcomes in triathlon: longitudinal observations across a full competitive season. *The Journal of Sports Medicine and Physical Fitness*, *50*(4), 475–485.

Malele, L., & Noorbhai, H. (2023). Prevalence and associated factors with mental health symptoms among semi-professional cricket players after the resumption of sporting activities following an extensive lockdown. *South African Journal of Sports Medicine*, *35*(1), Article v35i1a15058. https://doi.org/10.17159/2078-516X/2023/v35i1a15058

Marks-Anglin, A., Duan, R., Chen, Y., Panagiotou, O., & Schmid, C. H. (2021). Publication and outcome reporting bias. In C. H. Schmid, T. Theo, & I. R. White (Eds), *Handbook of meta-analysis* (pp. 283–292). CRC Press, Taylor & Francis Group.

Martinent, G., & Decret, J. C. (2015a). Motivational profiles among young table-tennis players in intensive training settings: A latent profile transition analysis. *Journal of Applied Sport Psychology, 27*(3), 268–287. https://doi.org/10.1080/10413200.2014.993485

Martinent, G., & Decret, J. C. (2015b). Coping profiles of young athletes in their everyday life: A three-wave two-month study. *European Journal of Sport Science, 15*(8), 736–747. https://doi.org/10.1080/17461391.2015.1051131

Martinent, G., Cece, V., & Guillet-Descas, E. (2022). The impact of stress, recovery and coping on burnout symptoms of young elite table-tennis players: A prospective multilevel study. *Frontiers in Psychology, 13*, Article 1007697. https://doi.org/10.3389/fpsyg.2022.1007697

Martinent, G., Cece, V., Elferink-Gemser, M. T., Faber, I. R., & Decret, J. C. (2018). The prognostic relevance of psychological factors with regard to participation and success in table-tennis. *Journal of Sports Sciences, 36*(23)*,* 2724–2731. https://doi.org/10.1080/02640414.2018.1476730

Martinent, G., Decret, J. C., Filaire, E., Isoard-Gautheur, S., & Ferrand, C. (2014). Evaluations of the psychometric properties of the Recovery-Stress Questionnaire for Athletes among a sample of young French table tennis players. *Psychological Reports, 114*(2), 326–340. https://doi.org/10.2466/03.14.PR0.114k18w2

McEwen, B. S., & Stellar, E. (1993). Stress and the individual: Mechanisms leading to disease. *Archives of Internal Medicine, 153*(18), 2093-2101. https://doi:10.1001/archinte.1993.00410180039004

Meeusen, R., Duclos, M., Foster, C., Fry, A., Gleeson, M., Nieman, D., Raglin, J., Rietjens, G., Steinacker, J., Urhausen, A., European College of Sport Science, & American College of Sports Medicine. (2013). Prevention, diagnosis, and treatment of the overtraining syndrome: Joint consensus statement of the European College of Sport Science and the American College of Sports Medicine. *Medicine and Science in Sports and Exercise*, *45*(1), 186–205. https://doi.org/10.1249/MSS.0b013e318279a10a

Moen, F., Abrahamsen, F., & Furrer, P. (2015). The effects from mindfulness training on Norwegian junior elite athletes in sport. *International Journal of Applied Sports Sciences, 27*(2), 98–113. https://doi.org/10.24985/ijass.2015.27.2.98

Moen, F., Federici, R. A., & Abrahamsen, F. (2015). Examining possible relationships between mindfulness, stress, school-and sport performances and athlete burnout. *International Journal of Coaching Science, 9*(1)*,* 3–19.

Moen, F., Hrozanova, M., Stiles, T. C., & Stenseng, F. (2019) Burnout and perceived performance among junior athletes-associations with affective and cognitive components of stress. *Sports, 7*(7), Article 171. https://doi.org/10.3390/sports7070171

Morgan, W. P., Costill, D. L., Flynn, M. G., Raglin, J. S., & O'Connor, P. J. (1988). Mood disturbance following increased training in swimmers. *Medicine and Science in Sports and Exercise*, *20*(4), 408–414. https://doi.org/10.1249/00005768-198808000-00014

Nafian, S., Vajdi, E., Dehkordi, A. N., Shahraki, F. G., Aghdaei, M., & Partovi, H. (2014). Evaluation of stress and burnout levels among individual and team male athletes. *Medicinski Glasnik*, *19*(53), 29–36.

NCAA. (2016). *Results of Division I time demands survey*. National Collegiate Athletic Association. https://ncaaorg.s3.amazonaws.com/research/d1/2016D1RES_TimeDemandsSurvey.pdf

Nicholls, A. R., & Polman, R. C. (2007). Coping in sport: A systematic review. *Journal of Sports Sciences*, *25*(1), 11–31. https://doi.org/10.1080/02640410600630654

Nixdorf, I., Beckmann, J., & Nixdorf, R. (2020). Psychological predictors for depression and burnout among German junior elite athletes. *Frontiers in Psychology, 11*, Article 601. https://doi.org/10.3389/fpsyg.2020.00601

Nuetzel, B. (2023). Coping strategies for handling stress and providing mental health in elite athletes: A systematic review. *Frontiers in Sports and Active Living*, *5*, Article 1265783. https://doi.org/10.3389/fspor.2023.1265783

Olsson, L. F., Grugan, M. C., Martin, J. N., & Madigan, D. J. (2022). Perfectionism and burnout in athletes: The mediating role of perceived stress. *Journal of Clinical Sport Psychology*, *16*(1), 55–74. https://doi.org/10.1123/jcsp.2021-0030

Page, M. J., Moher, D., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., & McKenzie, J. E. (2021). PRISMA 2020 explanation and elaboration: Updated guidance and exemplars for reporting systematic reviews. *BMJ, 372*, Article n160. https://doi.org/10.1136/bmj.n160

Pluhar, E., McCracken, C., Griffith, K. L., Christino, M. A., Sugimoto, D., & Meehan, W. P., 3rd. (2019). Team sport athletes may be less likely to suffer anxiety or depression than individual sport athletes. *Journal of Sports Science and Medicine*, *18*(3), 490–496. https://pubmed.ncbi.nlm.nih.gov/31427871/

Raanes, E. F. W., Hrozanova, M., & Moen, F. (2019). Identifying unique contributions of the coach-athlete working alliance, psychological resilience and perceived stress on athlete burnout among Norwegian junior athletes. *Sports*, *7*(9), Article 212. https://doi.org/10.3390/sports7090212

Raedeke, T. D., & Smith, A. L. (2001). Development and preliminary validation of an athlete burnout measure. *Journal of Sport and Exercise Psychology, 23*(4), 281–306. https://doi.org/10.1123/jsep.23.4.281

Raedeke, T. D., & Smith, A. L. (2004). Coping resources and athlete burnout: An examination of stress mediated and moderation Hypotheses. *Journal of Sport and Exercise Psychology, 26*(4), 525–541. https://doi.org/10.1123/jsep.26.4.525

Raedeke, T. D., & Smith, A. L. (2009). *The Athlete Burnout Questionnaire test manual*. Fitness Information Technology.

Raedeke, T. D., Arce, C., De Francisco, C., Seoane, G., & Ferraces, M. J. (2013). The construct validity of the Spanish version of the ABQ using a multi-trait/multi-method approach. *Anales de Psicología, 29(3)*, 693–700. https://doi.org/10.6018/analesps.29.3.175831

Reardon, C. L., & Factor, R. M. (2010). Sport psychiatry: A systematic review of diagnosis and medical treatment of mental illness in athletes. *Sports Medicine*, *40*(11), 961–980. https://doi.org/10.2165/11536580-000000000-00000

Reardon, C. L., & Hitchcock, M. (2024). Mental health in individual versus team sports. *International Review of Psychiatry*, *36*(3), 284–295. https://doi.org/10.1080/09540261.2024.2349079

Rice, S. M., Parker, A. G., Mawren, D., Clifton, P., Harcourt, P., Lloyd, M., Kountouris, A., Smith, B., McGorry, P. D., & Purcell, R. (2020). Preliminary psychometric validation of a brief screening tool for athlete mental health among male elite athletes: The Athlete Psychological Strain Questionnaire. *International Journal of Sport and Exercise Psychology, 18*(6), 850–865. https://doi.org/10.1080/1612197X.2019.1611900

Rosenthal, R. (1991). *Meta-analytic procedures for social research*. Sage. https://doi.org/10.4135/9781412984997

Saarinen, M., Phipps, D. J., Kuokkanen, J., Bjørndal, C. T., Bentzen, M., Ommundsen, Y., & Gustafsson, H. (2025). Burnout trajectories among adolescent student-athletes: The role of gender, success expectations, and parental affection. *Psychology of Sport and Exercise*, *79*, Article 102831. https://doi.org/10.1016/j.psychsport.2025.102831

Sarkar, M., & Fletcher, D. (2014). Ordinary magic, extraordinary performance: Psychological resilience and thriving in high achievers. *Sport, Exercise, and Performance Psychology, 3*(1), 46–60. https://doi.org/10.1037/spy0000003

Satow, L. (2012). *SCI – Stress and Coping Inventory.* In Leibniz Center for Psychological Information and Documentation (ZPID) (Ed.), *Electronic Test Archive* (PSYNDEX Tests No. 9006508). ZPID. https://doi.org/10.23668/psycharchives.424

Schulz, P., Schlotz, W., & Becker, P. (2004). *Trier Inventory for Chronic Stress (TICS)*. Hogrefe, Gottingen.

Shannon, S., Prentice, G., & Breslin, G. (2021). Athletes' psychological needs and coaches' interpersonal behaviors: A within-person latent profile analysis. *Journal of Sport and Exercise Psychology*, *43*(1), 71–82. https://doi.org/10.1123/jsep.2019-0295

Shannon, S., Prentice, G., Brick, N., Leavey, G., & Breslin, G. (2022). Longitudinal associations between athletes' psychological needs and burnout across a competitive season: A latent difference score analysis. *Journal of Sport and Exercise Psychology*, *44*(4), 240–250. https://doi.org/10.1123/jsep.2021-0250

Shipherd, A. M., Avery, C, Gomez, S., & Renner, K. B. (2024). The relationship between stress mindset and burnout in college athletes. *Journal of Athlete Development and Experience*, *6*(1), Article 2. https://doi.org/10.25035/jade.06.01.02

Smith, A. L., Gustafsson, H., & Hassmén, P. (2010). Peer motivational climate and burnout perceptions of adolescent athletes. *Psychology of Sport and Exercise, 11*(6), 453–460. https://doi.org/10.1016/j.psychsport.2010.05.007

Smith, R. E. (1986). Toward a cognitive-affective model of athletic burnout. *Journal of Sport Psychology, 8*(1), 36–50. https://doi.org/10.1123/jsp.8.1.36

Sun, T., Horn, M., & Merritt, D. (2004). Values and lifestyles of individualists and collectivists: A study on Chinese, Japanese, British, and US consumers. *Journal of Consumer Marketing, 21*(5)*,* 318–331. https://doi.org/10.1108/07363760410549140

Vaughan, R. S., Edwards, E. J., & MacIntyre, T. E. (2020). Mental health measurement in a post Covid-19 world: Psychometric properties and invariance of the DASS-21 in athletes and non-athletes. *Frontiers in Psychology, 11*, Article 590559. https://doi.org/10.3389/fpsyg.2020.590559

Verhagen, A., & Ferreira, M. (2014). Forest plots. *Journal of Physiotherapy, 60*(3), 170–173. https://doi.org/10.1016/j.jphys.2014.06.021

Wagstaff, C., Hings, R., Larner, R., & Fletcher, D. (2018). Psychological resilience's moderation of the relationship between the frequency of organizational stressors and burnout in athletes and coaches. *The Sport Psychologist, 32*(3), 178-188. https://doi.org/10.1123/tsp.2016-0068

Wang, E. T. W., Lee, W. P., & Lu, F. J. H. (2015). How coping resource reduces athletes' burnout in sport settings: The mediating role of life stress. *Physical Education Journal*, *48*(3), 251–264. https://doi.org/10.3966/102472972015094803003

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 trial. *International Journal of Environmental Research and Public Health*, *20*(3), Article 2038. https://doi.org/10.3390/ijerph20032038

Warttig, S. L., Forshaw, M. J., South, J., & White, A. K. (2013). New, normative, English-sample data for the Short Form Perceived Stress Scale (PSS-4). *Journal of Health Psychology*, *18*(12), 1617–1628. https://doi.org/10.1177/1359105313508346

Wilczyńska, D., Qi, W., Jaenes, J. C., Alarcón, D., Arenilla, M. J., & Lipowski, M. (2022). Burnout and mental interventions among youth athletes: A systematic review and meta-analysis of the studies. *International Journal of Environmental Research and Public Health*, *19(*17), Article 10662. https://doi.org/10.3390/ijerph191710662

Woods, S., Dunne, S., & Gallagher, P. (2023). Examining the utility of stress-, motivation-, and commitment-based perspectives of athlete burnout. *Journal of Sport and Exercise Psychology, 45*(5), 257–268. https://doi.org/10.1123/jsep.2022-0127

Woods, S., Dunne, S., Gallagher, P., & Harney, S. (2022). Is a pandemic as good as a rest? Comparing athlete burnout and stress before and after the suspension of organised team sport due to Covid-19 restrictions, and investigating the impact of athletes' responses to this period. *Psychology of Sport and Exercise, 60*, Article 102168. https://doi.org/10.1016/j.psychsport.2022.102168

Woods, S., Dunne, S., Gallagher, P., & McNicholl, A. (2025). A systematic review of the factors associated with athlete burnout in team sports. *International Review of Sport and Exercise Psychology*, *18*(1), 70–110. https://doi.org/10.1080/1750984X.2022.2148225

Wu, D., Luo, Y., Ma, S., Zhang, W., & Huang, C.-J. (2022). Organizational stressors predict competitive trait anxiety and burnout in young athletes: Testing psychological resilience as a moderator. *Current Psychology, 41*(12), 8345–8353. https://doi.org/10.1007/s12144-021-01633-7

Wu, X., Zainal Abidin, N. E., & Aga Mohd Jaladin, R. (2021). Motivational processes influencing mental health among winter sports athletes in China. *Frontiers in Psychology, 12*, Article 726072. https://doi.org/10.3389/fpsyg.2021.726072

Yang, M.-H., Hsueh, K.-F., Chang, C.-M., & Hsieh, H.-H. (2023). The influences of sports psychological capital to university baseball athletes' life stress and athlete burnout. *Behavioral Sciences, 13*(8), Article 617. https://doi.org/10.3390/bs13080617

Yu, X., Xing, S. & Yang, Y. (2025). The relationship between psychological capital and athlete burnout: The mediating relationship of coping strategies and the moderating relationship of perceived stress. *BMC Psychology 13*, Article 64. https://doi.org/10.1186/s40359-025-02379-8

Appendix A. Characteristics of Included Studies

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
1	Raedeke & Smith (2001)	USA	244/ 15.8 ± 1.3/ elite level/ 8.0 ± 2.9 years	Quantitative research/ psychometrics	To develop a psychometrically sound measurement of athlete burnout.	Stress correlated positively with burnout.	ABQ (Raedeke & Smith, 2001)	PSS (Cohen et al., 1983)
2	Raedeke & Smith (2004)	USA	244/ 15.8 ± 1.3/ elite level/ 8.0 ± 2.9 years	Quantitative research/ psychometrics	To examine whether coping behaviors and satisfaction with social support (a) have indirect stress-mediated relationships with burnout or (b) disjunctively or conjunctively moderate the relationship between perceived stress and burnout.	Stress correlated positively with burnout.	ABQ (Raedeke & Smith, 2001)	PSS (Cohen et al., 1983)
					To examine stress as a mediator or moderator between variables and burnout.			
3	Black & Smith (2007)	USA	182/ 16.0 ± 1.6/ elite level/ 7.30 years	Quantitative research/ psychometrics	Coakley's (1992) perspective on athlete burnout among adolescents posits that a narrow identity and local opportunity to exert control over one's sports experience contribute to athlete burnout.	Life stress correlated positively with burnout.	ABQ (Rakede & Smith, 2001)	PSS (Cohen et al., 1983)/
4	Grobbelaar et al. (2010)	South Africa	41/ 21.87± 1.39/ elite level /13.76 years	Quantitative research/ psychometrics/ longitudinal - 5 months	To compare the recovery stress, burnout, and mood state scores of elite student rugby players based on their playing position, experience level, and starting status.	1. Experienced players exhibited significantly different life stress levels, but there was no significant difference in burnout.	ABQ (Raedeke & Smith, 2001)	RESTQ-52 sport (Kellmann & Kallus, 2001)

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
						2. Different positions had significant differences in Sport-Specific Stress and Burnout (Backline players > Forwards).		
5	Main et al. (2010)	Australia	30/ male=27.1± 9.1, female=27.4± 6.6/ -/ 5.20 years	Quantitative research/ psychometrics/ longitudinal - 45 weeks	To determine whether exposure to stressors had a significant effect on the experience of various negative health outcomes.	Life stress had a longitudinal effect on the burnout.	ABQ (Raedeke & Smith, 2001)	PSS-10 (Cohen et. al., 1983)/ LS
6	Smith et al. (2010)	Sweden	206/ 17.2± 1.0/ not elite level/ -	Quantitative research/ psychometrics	To examine the association between perceptions of the peer-created motivational climate and athlete burnout in adolescent athletes while controlling perceived stress.	Higher perceived life stress is associated with higher scores on burnout.	ABQ (Raedeke & Smith, 2001)/ DV	PSS (Cohen et al., 1983)/ IV-predictor
7	Gustafsson et al. (2011)	Sweden	258/ 17.3± 1.0/ -/ -	Quantitative research/ psychometrics	To examine whether harmonious passion and obsessive passion pose equal risks for burnout and stress.	Athletes with a Harmonious passion were significantly negatively correlated with burnout and life stress; athletes with obsessive passion were significantly positively correlated with burnout and perceived life stress.	ABQ (Rakede & Smith, 2001)/ DV	PSS (Cohen et al, 1983)/ DV
8	Gustafsson & Skoog (2012)	Sweden	217/ 17.21± 0.95/ not elite level/ -	Quantitative research/ psychometrics	To investigate whether stress serves as a mediator of the relationship between optimism and burnout symptoms in athletes.	Life stress was significantly related to burnout. The more stressful the athletes perceived the situation to be, the higher the degree of burnout; the	ABQ (Raedeke & Smith, 2001,2009)/ DV	PSS (Cohen et al., 1983)/ / mediator

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
						lower the sense of accomplishment, the greater burnout perceived.		
9	Lu et al. (2012)	Taiwan	334/ 19.26± 1.42/ not elite level/ -	Quantitative research/ psychometrics	To develop a reliable and valid measurement assessing college student-athletes' life stress.	Most subscales of the 24-item CSALSS had low to moderate positive associations with the three dimensions of burnout.	ABQ-11 (Raedeke & Smith, 2001; revised by Lu et al., 2006)	CSALSS, (Lu et al., 2012)
10	Gustafsson et al. (2013)	Sweden	238/ 17.0± 0.9/ not elite level/ 10.72 years	Quantitative research/ psychometrics	To examine whether stress mediated the relationship between trait hope and burnout in elite junior soccer players.	Life stress was positively correlated with burnout. And the associations between stress and burnout were strong.	ABQ (Raedeke & Smith, 2001)/ DV	PSS (Cohen et. al., 1983)/ mediator
11	Raedeke et al. (2013)	Spanish	302/ 19.06 ± 3.88/ -/ 6.95 years	Quantitative research/ psychometric	To evaluate construct validity evidence associated with the Spanish version of ABQ and related to stress.	The correlations between burnout and related markers of ill-being, including sports stress, anxiety, and depression, were low to moderate. These findings suggest that burnout and related markers of ill-being are distinct yet related constructs.	ABQ (Raedeke & Smith, 2001,2009)	DASS-21 -Spanish version (Bados, et al., 2005)
12	DeFreese & Smith (2014)	USA	465/ 19.7± 2.3/ not elite level/ 8.10 years	Quantitative research/ psychometric/ longitudinal-4 time point of the competitive season	To examine perceived social support and negative social interactions as potential moderators of temporal stress burnout.	Life stress was positively temporally associated with burnout.	ABQ (Raedeke & Smith, 2009)/ DV	PSS (Cohen et. al., 1983)/ IV

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
13	Martinent et al. (2014)	France	148/ 14.2± 2.1/ not elite level/ 6.50 years	Quantitative research/ psychometric	Test the original 19-factor and the new 14-factor structure of the Recovery-Stress Questionnaire for Athletes, and examine the correlation between RESTQ-Sport and burnout.	Both sport stress and life stress subscales were correlated positively with burnout.	ABQ-French v (Isoard et al., 2010)/ IV	RESTQ-sport-French version (Martinet, 2014)/ DV
14	Dubuc-Charbonneau & Durand-Bush (2015)	Canada	8 / 20.2 / not elite level/ 2.00 years	Mixed methods design/ psychometric/intervention - 2 months	To ssess the impact of a person-centered, feel-based self-regulation intervention on stress and burnout. [intervention: self-regulation]	Life stress and burnout levels significantly decreased as the intervention progressed.	ABQ (Raedeke & Smith, 2001) / DV	PSS (Cohen et al., 1983) / DV
15	Gustafsson et al. (2015)	Sweden	233/ 17.5± 1.08/ -/ 8.00 years	Quantitative research/ psychometric	To examine whether the relationship mediates stress between mindfulness and stress.	A moderate association was found between perceived life stress and burnout.	ABQ (Raedeke & Smith, 2001)/ DV	PSS (Cohen et al., 1983) / mediator
16	Martinent & Decret (2015a)	France	141/ 13.85± 2.04/ elite level/6.18 years	Quantitative research/ psychometric/ longitudinal – 6~8 months	To examine whether athletes from different motivational profiles differ in terms of stress and burnout.	Athletes from the moderate profile of motivation have experienced higher levels of burnout, and life and sport-specific stress	ABQ-French v (Isoard et al., 2010)/ DV	RESTQ-French v (Martinet et al., 2014)/ DV
17	Martinent & Decret (2015b)	France	147/ 13.91± 2.03/ elite level/ 6.23 years	Quantitative research/ psychometric/ longitudinal – 6~8 months	TO examine whether young athletes from distinct coping profiles differ in their responses to daily stressors in terms of burnout and stress.	Different coping profile athletes had a significant difference in both types of stress and burnout (DgOC & DtOC profile > TOC profile, low coping profile)	ABQ-French version (Isoard-Gautheur et al., 2010)/ DV	RESTQ-Sport -French version (Martinent et al., 2014)/ DV

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
18	Moen, Federici, & Abrahamsen (2015)	Norway	382/ 18.5/ elite level / -	Quantitative research/ psychometric	To investigate the impact of mindfulness on stress and athlete burnout.	Life stress was positively correlated with burnout.	ABQ- reduced version from Raedeke & Smith, 2009/ DV	PSS-14 (Cohen, 1983)/ IV /mediator
19	Moen, Abrahamsen, & Furrer (2015)	Norway	77/ 18.5(16~20)/ elite level / -	Quantitative research/ psychometric/ intervention	To investigate the effects of a 12-week mindfulness intervention on perceived stress and athlete burnout among junior elite athletes in sports. [intervention: mindfulness]	Life stress was positively correlated with burnout.	ABQ (Raedeke & Smith, 2009)/ DV	PSS-14 (Cohen et al., 1983)/ DV
20	Wang et al. (2015)	Taiwan	244/ 19.98± 1.37/ not elite level / 8.91 years	Quantitative research/ psychometric	To examine whether social support has life stress-mediated influences on athletes' burnout.	Both daily life stress and sports life stress are significantly associated with athlete burnout.	ABQ (translated by (Lu et al., 2006; Raedeke & Smith, 2001)/ DV	CSALSS (Lu et al., 2012)/ mediator
21	Chiu et al. (2016)	Taiwan	196 (study 2)/ 19.88± 1.35/ -/ -	Quantitative research/ psychometric	To examine the measurement invariance of the PSS between athletes and non-athletes, and assess the construct validity and reliability in sports contexts.	Both sports stress and life stress were positively related to burnout.	ABQ (Raedeke & Smith, 2001)/ DV	CSALSS (Lu et al., 2012)
22	De Francisco et al. (2016)	Spanish	453/ 13~29/ elite level / 7.23 years	Quantitative research/ Structural psychometric	To investigate the relationship among perceived stress, burnout, and depression in athletes.	Sports stress has a direct, positive effect on burnout.	ABQ (Rakede & Smith, 2001, 2009)	DASS-21-Spanish version (Bados et al., 2005)/
23	Lu et al. (2016)	Taiwan	218/ 20.0± 1.3/ -/ 9.10 years	Quantitative research/ psychometric	To examine the conjunctive effects of athletes' resilience and coaches' social support on	Both Sport stress and life stress had a significantly positive relationship with burnout.	ABQ (Raedeke & Smith, 2001)/ DV	CSALSS, (Lu et al., 2012)/ IV

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
					the relationship between life stress and burnout.			
24	Chang et al. (2017)	Taiwan	300 / 20.43 ± 1.68 / -/ 9.83 ± 3.42 y	Quantitative research/ psychometric	To examine the mediating role of negative thoughts on the stress-burnout relationship.	Sport stress and life stress are both significantly correlated with burnout.	ABQ (Raedeke & Smith, 2001) / DV	CSALSS, (Lu et al., 2012)/ IV
25	Frank et al. (2017)	Germany	194 / 15.08 ± 1.95 / not elite level / -	Quantitative research/ psychometric	To assess burnout and depression along with stress measurements.	Life stress was positively associated with burnout.	ABQ (Raedeke & Smith, 2001) / DV	TICS (Schulz et al., 2004) / IV
26	Gustafsson et al. (2017)	Sweden	255/ 16.95± 0.86/ elite level / 8.80 years	Quantitative research/ psychometric	To investigate the fear of failure in highly competitive junior athletes and its association with psychological stress and burnout.	Life stress was positively correlated with burnout.	ABQ (Raedeke & Smith, 2001)/ DV	PSS (Cohen et al., 1983)/ DV
27	Lee et al. (2017)	Korea	332/ 17.57± 0.62/ elite level / -	Quantitative research/ psychometric	To test the structural relationships between stress and burnout in student-athletes	Sports stress and life stress were both significantly positively correlated with burnout.	ABQ (Raedeke & Smith, 2001)/ mediator	Stress scale for PEHS (Lee et al., 2014)/IV
28	Chyi et al. (2018)	Taiwan	195 / 19.89 ± 1.34 / -/ 7.56 ± 2.83 years	Quantitative research/ psychometric	To xamine the relationships among athletes' life stress, perceived stress, and burnout, and investigate the mediating or moderating role of perceived stress on the life stress–burnout relationship.	1. Athlete burnout showed a higher correlation with sport-specific life stress compared to general-life stress and perceived distress. But burnout negatively correlated with counter-stress. 2. Sport-specific stress and general-life stress positively predicted perceived distress and burnout. And perceived	ABQ (Raedeke & Smith, 2001) / DV	1. PSS (Cohen et al., 1983) /IV /mediator 2. CSALSS (Lu et al., 2012)/ IV/mediator

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
						distress positively predicted burnout.		
29	Garinger et al. (2018)	USA	351 / 19.97 ± 1.47 /-/ 7.00 years	Quantitative research/ psychometric	To examine the influence of perfectionistic strivings and concerns on burnout and perceived stress as a mediator of this relationship in players	Life stress was positively correlated with burnout.	ABQ (Raedeke & Smith, 2001) / DV	PSS (Cohen et. al., 1983) / mediator
30	Gerber, Best, & et al. (2018)	Switzerland	197 / 16.83 ± 1.40 / elite level/ 7.79 ± 3.07 years	Quantitative research/ psychometric/ longitudinal – 6 months	To examine the psychometric properties of a German version of the ABQ and its usefulness as a screening tool to detect clinically relevant burnout symptoms such as stress.	Life stress was positively correlated with burnout, as measured by ABQ and SMBM.	1. ABQ (Raedeke & Smith, 2001) / DV 2. SMBM (Lerman et al., 1999) / DV	PSS (Cohen et al., 1983) / DV
31	Gerber, Colledge, & et al. (2018)	Switzerland	257 (sample 3) / 16.82 ± 1.44 / elite level / -	Quantitative research/ psychometric	To examine the psychometric properties of the SMBM in three independent samples of adolescents (sample 3 were athletes)	Life stress was positively correlated with burnout.	SMBM (Lerman et al., 1999) / DV	PSS (Cohen et al., 1983) / IV
32	Gerber, Gustafsson, & et al. (2018)	Switzerland	257 / 16.82 ± 1.44 / n/a	Quantitative research/ psychometric/ longitudinal – 6 months	To examine the presence of clinically relevant symptoms of burnout and the potential interaction between perceived stress and burnout symptoms.	Higher life stress scores were associated with higher levels of burnout.	SMBM (Lerman, et al., 1999) / DV	PSS-10 (Cohen, 1983) / IV
33	Liu et al. (2018)	Taiwan	115 / 19.83 ± 1.28 / -/ -	Quantitative research/ psychometric	To translate the Organisational Stressor Indicator for Sports Performers (OSI-SP) into Chinese and examine the relationships among OSI-SP subscales, the College Student-Athlete Life Stress Scale, and	Life stress was significantly correlated with burnout.	ABQ (Raedeke & Smith, 2001) / DV	CSALSS, (Lu et al., 2012)

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
					burnout among Taiwanese athletes.			
34	Lu et al. (2018)	Taiwan	312 (study 4) / 19.87 ± 1.54/ not elite level/ -	Quantitative research/ psychometric	To examine the relationships among AMES subscales, life stress in college student-athletes, and burnout.	Both sport stress and life stress were significantly positively correlated with burnout.	ABQ (Raedeke & Smith, 2001) / DV	CSALSS, (Lu et al., 2012)/ DV
35	Martinent et al. (2018)	France	159 / 14.07 ± 2.13 / elite level/ 6.36 years	Quantitative research/ psychometric/ longitudinal – 6 years	To examine the prognostic relevance of burnout, perceived stress, and other variables.	Athletes' performance was weakly correlated to stress and moderately correlated to burnout.	ABQ (French version, Isoard-Gautheur et al., 2010) / DV	RESTQ (French version, Martinent et al., 2014)/ IV
36	Gabana et al. (2019)	USA	51 /19.8 ± 1.2 / -/ -	Quantitative research/ psychometric/ intervention – gratitude attitude	To explore the psychological distress and athlete burnout after an intervention of the Attitude of Gratitude workshop.	Significant time affects psychological distress and burnout; both stress and burnout decreased as time went on.	ABQ (Radeke & Smith, 2001)/ DV	BSI-18 (Derogatis, 2001) / DV
37	Moen et al. (2019)	Norway	670 / 18.00/ elite level / -	Quantitative research/ psychometric	To investigate associations between perceived stress, athlete burnout, and other variables.	Life stress was positively associated with burnout.	ABQ (Raedeke & Smith, 2004) / DV	PSS-14 (Cohen et al., 1983) / IV
38	Raanes et al. (2019)	Norway	670 / 17.98 ± 0.89 / elite level/ -	Quantitative research/psychometrics	To examine how perceived stress and other variables are associated with athlete burnout.	Stress was positively associated with burnout.	ABQ (Raedeke & Smith, 2001, 2009) / DV	PSS (Cohen et al., 1983) / DV
39	Åkesdotter et al. (2020)	Sweden	333 / 19.2 / elite level/ -	Quantitative research/ psychometric	To investigate if sport-specific instruments (PSS & burnout) could indicate clinical levels of psychiatric symptoms.	Both life stress and burnout were significantly different by sex (Female > Male).	ABQ (Raedeke & Smith, 2009 / DV	PSS-4 (Warttig et al., 2013) / IV

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
40	Chiou et al. (2020)	Taiwan	1. 230(Study 1) / 19.92 ± 1.59 / -/6.46 years 2. 159 (study 2)/ 20.2 ± 2.04 / -/ 9.20 years	Quantitative research/ psychometric	To examine the moderating effects of athletic mental energy on the athletes' life stress–-burnout relationship.	Both results showed that life stress and sports stress were positively associated with burnout.	ABQ (Raedeke & Smith, 2001) / IV	CSALSS, (Lu et al., 2012)/ IV
41	Dobson et al. (2020)	USA	13 / 19 ± 1.0 / elite level/ -	Quantitative research/ Experimental Approach/ longitudinal – 6 months	To use psychological stress and burnout to investigate the impact of overload training and tapering in female swimmers.	Both sport stress and life stress and burnout levels were increased by training loading.	ABQ (Raedeke & Smith, 2001) / DV	RESTQ-52 sport (Kellmann & Kallus, 2001)/ DV
42	Nixdorf et al. (2020)	Germany	85 / 14.82 ± 2.26 / not elite level/ -	Quantitative research/ psychometric/ longitudinal – 6 months	To Assess possible vulnerabilities in a training and preparation phase; stressors (chronic stress) and burnout were assessed during a competitive season.	A high level of chronic stress was relevant to burnout	ABQ (German version, Ziemainz et al., 2004) / DV	TICS (Schulz et al., 2004)/ IV
43	Vaughan et al. (2020)	UK	589 / 23.54 ± 9.38 / partial elite level/ 8.82 years	Quantitative research/ psychometric/ questionnaire developed	To assess the correlation between DASS-21 subscales and athlete burnout.	Life stress was positively associated with burnout.	ABQ (Raedeke & Smith, 2001)	DASS-21 (Lovibond & Lovibond, 1995)
44	Fagundes et al. (2021)	Brazil	32 / 24.16 ± 4.58 / elite level/ 4.82 years	Quantitative research/ psychometric	To examine whether the stress of overtraining predicts athletes' burnout	Life stress was positively associated with burnout.	ABQ (Brazilian version, Guedes & Souza, 2016) / DV	RESTQ-76 sport (Kellmann & Kallus, 2001)/IV
45	Wu et al. (2021)	China	685 / 20.5 ± 1.5 / not elite level/ -	Quantitative research/ psychometric	To examine the association of motivation with psychological distress and burnout.	Life stress was positively associated with burnout.	ABQ (Raedeke & Smith, 2001) / DV	DASS-21 (Lovibond & Lovibond, 1995)/ DV

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
46	Daumiller, et al. (2022)	Germany	125 / 23.7 ± 4.0 / elite level/ -	Quantitative research/ psychometric	To examine the effects of achievement goals on athlete burnout levels and psychosomatic stress symptoms.	Life stress was positively associated with burnout.	ABQ-D (German version, Ziemainz et al., 2004)	SCI (Satow, 2012)
47	Glandorf et al. (2022)	UK	N=95 / 23.12± 6.87/ not elite level/ 8 years	Quantitative research/ psychometric/ longitudinal – 3~12 weeks	To test whether team identification predicts athlete burnout through a serial mediation of perceived support and stress.	Life stress was positively associated with burnout.	ABQ (Raedeke & Smith, 2001)/DV	PSS (Cohen et al., 1983)/ Mediator
48	Liu et al. (2022)	China	672 / 19.5 ± 0.5 / elite level/ -	Quantitative research / psychometric	To evaluate the mediating role of stress between psychological distress and athletic burnout during the COVID-19 pandemic.	Life stress was positively associated with burnout.	ABQ (Raedeke & Smith, 2001) / DV	PSS-10 (Cohen, 1983) / IV-mediator
49	Martinent et al. (2022)	French	159 / 14.07 / elite level/ 6.36 years	Quantitative research/ psychometric/ longitudinal – 3 months	To explore the role of stress in athlete burnout symptoms, considering both individual and contextual factors (such as training group).	Sports stress was positively associated with burnout; however, stress did not significantly predict burnout when other factors were considered.	ABQ (French version, Isoard-Gautheur et al., 2010) / DV	RESTQ-Sport (Martinent et al., 2014) / IV
50	Olsson et al. (2022)	UK	256 / 21.26 ± 4.73 / -/ 8.38 ± 4.56 years	Quantitative research / psychometric	To examine the relationships between perfectionism, perceived stress, and athlete burnout, explicitly testing whether perceived stress mediates the perfectionism-burnout relationship	Perceived stress was positively related to athlete burnout.	ABQ (Raedeke & Smith, 2001)/DV	PSS (Cohen et al., 1983)/ Mediator

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
51	Woods et al. (2022)	Ireland	N=92 / 27.05 ± 7.56 y / partial elite level/ 5.50 years	Quantitative research/ psychometric/ longitudinal – 14 months	To compare levels of burnout and stress reported by Gaelic games athletes before and after the COVID-19 suspension period, and examine how athletes utilized and perceived this period.	Perceived stress was positively related to athlete burnout.	ABQ (Raedeke & Smith, 2001)/DV	PSS-10 (Cohen et al., 1994)/ LS (perceived daily-life stress)/ IV
52	Wu et al. (2022)	China	506 / 21.3 y / not elite level/ 8.9 ± 3.60 years	Quantitative research/Correlational study with conditional process analysis	To investigate how resilience affects the relationships between organizational stressors and burnout.	Organizational stressors were positively related to athlete burnout.	ABQ (Raedeke & Smith, 2001)/DV	OSI-SP (Arnold et al., 2013)/ IV
53	Gerber et al. (2023)	Swiss	135 / 16.76 ± 1.36 / elite level/ 8.27 years.	Quantitative research/ psychometric/ longitudinal – 10 months	To examine the predictive value of stress states for burnout symptoms.	Sports stress was positively associated with burnout.	SMBM (Lerman Y, et al., 1999) / DV	ARSS (Hitzschke B et al., 2015)/ IV
54	Malele & Noorbhai (2023)	South Africa	63 / 24 ± 5 / not elite level/ -	Quantitative research/ psychometric	To investigate the prevalence of mental health symptoms (stress, burnout) among cricket players during COVID-19	Stress at a moderate level, and burnout at a low level.	ABQ (Raedeke & Smith, 2001)/ DV	DASS-21 (Lovibond & Lovibond, 1995) / DV
55	Yang et. al. (2023)	Taiwan	428 / 19.18 / elite level/ 9.21 years	Quantitative research/ psychometric	To explore the influences of athletes' psychological capital on their life stress and burnout.	Life stress was positively associated with burnout.	ABQ (Chinese version, Lu et al., 2006)	CSALSS, (Lu et al., 2012)/ IV
56	Woods et al. (2023)	Ireland	370 / 24.32 ± 5.95 / partial elite level/ -	Quantitative research / psychometric	To assess the utility of the stress perspective and identify key predictors of burnout in athletes.	Perceived stress was positively related to athlete burnout.	ABQ (Raedeke & Smith, 2001)/ DV	PSS-10 (Cohen & Williamson, 1988)/ IV

NO	Author(s)	Country	N of Sample/ Ave. Age/ athletic level/ sports experiences	Study design/ main analysis approach	Study purpose about stress-burnout	Main findings of the relationship between S and B	Measurement of Burnout	Measurement of Stress
57	Gao & Wang (2024)	China	501 / 20.74 ± 2.51 / elite level/ -	Quantitative research / psychometric	To explore the relationship and influencing pathways between mental health indicators (including stress) and athlete burnout among Chinese competitive athletes.	Perceived stress was positively related to athlete burnout.	ABQ (Raedeke & Smith, 2001)/DV	APSQ (Rice et al., 2020)/ /IV
58	Levillain et al. (2024)	France	175 / 20.30 ± 3.75 / not elite level / 9.55 ± 5.04 years	Quantitative research / psychometric	To explore the relationships between stress, burnout, and other variables.	Perceived stress was positively related to athlete burnout.	ABQ-S (Isoard-Gautheur et al., 2018)/ DV	SRSS (Kellmann et al., 2016)/IV
59	Yu et al. (2025)	China	344 / 17.68 ± 3.8 / not elite level/ -	Quantitative research / psychometric	To examine the relationships among perceived stress, athlete burnout, and other variables.	Perceived stress was positively related to athlete burnout.	ABQ (Raedeke & Smith, 2001)/DV	PSS (Cohen et al., 1983)

Note. ABQ- Athletes Burnout Questionnaire; MBI- Maslach Burnout Inventory; SMBM: Shirom-Melamed Burnout Measure; PSS- Perceived Stress Scale; CSALSS- College Student–Athletes' Life Stress Scale; REST-Q- Recovery-Stress Questionnaire for Athletes; DASS- Depression Anxiety Stress Scales; TICS- Trier Inventory of Chronic Stress; Stress scale for PEHS- stress scale for physical education high school students; SCI- Stress and Coping Inventory. ABQ–E: perceived emotional and physical exhaustion; ABQ–D: devaluation of sports participation; ABQ–RA: a reduced sense of athletic accomplishment; IPA: Through interpretive phenomenological analysis; ARSS: Acute Recovery and Stress Scale; APSQ: Athlete Psychological Strain Questionnaire.