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Injury anxiety, and psychological well-being in professional football players: a mixed-methods examination of competition-related rumination

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Abstract

Background Sports injuries are an important source of psychological strain in professional football and may increase injury-related anxiety while reducing psychological well-being. This study examined associations among injury anxiety, competition-related rumination, and psychological well-being and tested whether rumination statistically mediated the anxiety-well-being relationship.

Methods A sequential mixed-methods design combined quantitatively driven hypothesis testing with qualitative inquiry. Quantitative data from 106 professional football players who had completed rehabilitation following surgically treated serious injuries were analyzed using SEM; 40 participants also completed semi-structured interviews analyzed with reflexive thematic analysis. Time since the most recent serious injury was included as a covariate. Given the highly parameterized SEM, modest sample size, and multivariate non-normality, findings were supplemented with overlap-exclusion, covariate-adjusted, and 5,000-resample bootstrap robustness analyses.

Results Injury anxiety was negatively associated with psychological well-being in the primary SEM (β=-0.350, p=.029), whereas injury anxiety was not significantly associated with rumination (β = 0.068, p=.566), and rumination was not associated with psychological well-being (β = 0.003, p=.976). The indirect effect was approximately zero, and supplementary bootstrap confidence intervals included zero. The inverse anxiety-well-being association remained significant in the full-sample covariate-adjusted model (β=-0.295, p=.001) but was attenuated and non-significant in the overlap-exclusion analysis (β=-0.190, p=.140). Qualitative findings indicated that repetitive injury-related thoughts were intermittent and phase-sensitive and that psychological strain involved career continuity, identity, belonging, and support.

Conclusions Injury anxiety was inversely associated with psychological well-being, but generalized competition-related rumination was not supported as a mediating pathway. Causal, temporal, and rehabilitation-phase interpretations are not warranted. Mixed-methods integration highlighted divergence between episodic qualitative accounts and generalized rumination scores and identified relational and organizational factors for future research.

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Keywords Injury anxiety · Rumination · Psychological well-being · Professional football · Mixed-methods · Sport psychology · Reflexive thematic analysis

Introduction

Professional football is characterized by high physical demands, and dense competition calendars; accordingly, injury incidence remains substantial across leagues, and seasons. Meta-analytic evidence indicates an overall injury incidence of approximately 8 injuries per 1,000 h of exposure in professional male football, with match incidence rising to ~ 36 injuries per 1,000 h-nearly an order of magnitude higher than training exposure [1]. Systematic evidence likewise shows that both professional, and amateur male footballers face comparable overall injury rates, albeit with differences in mechanism (contact vs. non-contact), and injury profile [2]. From a club perspective, injury episodes are therefore not merely biomedical events but recurring disruptions that carry performance, role-security, and career-continuity implications. Beyond time-loss, and performance disruption, sports injuries are frequently associated with adverse psychological consequences, including heightened anxiety, and reductions in subjective well-being [3]. Recent systematic evidence also indicates that kinesiophobia and fear of reinjury are important psychological concerns among injured athletes and are associated with poorer physical and psychological outcomes during rehabilitation and return-to-sport processes [4].

Within this context, injury anxiety can be conceptualized as a dispositional tendency to appraise sport situations through the lens of injury-related threat, encompassing cognitive (e.g., catastrophic scenarios), affective (e.g., fear), and behavioral (e.g., avoidance or cautiousness) components. The Sport Injury Anxiety Scale (SIAS) operationalizes this construct across multiple threat domains, including fear of re-injury, fear of losing ability, and fear of appearing weak [5]. Two theoretical models are relevant here, and they explain different things. The stress-injury model identifies threat appraisal and stress-related attentional disruption as pathways linking psychological stress to the occurrence of injury [6, 7]. The integrated model of response to sport injury describes how cognitive appraisals shape emotional and behavioral responses after an injury has occurred [8]. Separately from these models, empirical return-to-sport research, including systematic-review evidence, identifies fear of re-injury and psychological readiness as factors associated with functional recovery, with potential implications for athletes' broader psychological well-being [9–11].

Rumination refers to repetitive negative thinking that can be difficult to disengage from and may prolong stress-related activation [12, 13]. In competitive sport, however, rumination should not be treated as synonymous with post-event processing. The Sports Competition Rumination Scale (SCRS) used in the present study assesses a generalized tendency toward repetitive negative thinking across the competition context rather than separately measuring pre-competition, in-competition, or post-competition episodes [14]. Recent sport research further indicates that rumination can vary with goals, situational demands, and state-like experiences, and newer work has begun to examine shorter and more context-sensitive approaches to its assessment [15, 16]. Accordingly, post-event processing is considered an adjacent theoretical literature rather than a direct operational definition of the construct measured here. More recent work has further refined the assessment of competition-related rumination through the development of a short form of the SCRS (SCRS-SF), reflecting continued efforts to improve the practical and research-oriented measurement of this construct in competitive athletes [17].

Psychological well-being (PWB) broadly concerns positive psychological functioning, meaning, competence, engagement, and the quality of one's life experience. Ryff's eudaimonic framework provides an important theoretical account of positive functioning [18–20], while Self-Determination Theory emphasizes autonomy, competence, and relatedness as conditions relevant to well-being [21]. Importantly, the present study did not measure a sport-specific or Ryff-domain-specific form of well-being. It used the eight-item global Psychological Well-Being/Flourishing measure developed by Diener and colleagues, which provides a unidimensional index

of perceived positive functioning [22, 23]. Interpretations are therefore restricted to general psychological well-being rather than sport-specific well-being domains.

Sport-injury research increasingly conceptualizes psychological responses as dynamic and embedded in rehabilitation, return-to-sport, and social contexts rather than as isolated symptoms [24]. Studies in Turkish athlete samples have linked injury anxiety with coping-related processes, pain-related fear, kinesiophobia, participation-related factors, and athlete characteristics [25–27]. Contemporary studies also point to alternative or interacting cognitive processes -including coping strategies, psychological flexibility, mindful awareness, and context-sensitive rumination- that may shape athlete adjustment [28, 29]. These developments make it important to test the proposed rumination pathway while remaining open to alternative explanations if mediation is not supported.

Recent rumination research in sport also suggests that findings can differ by population, outcome, and temporal frame. Competition-related rumination has been associated with subjective sport evaluations and well-being-related outcomes in some samples, whereas experimental and applied work indicates that state rumination may emerge transiently in performance contexts [15, 16]. In Turkish and other athlete samples, rumination has been examined in relation to cognitive-behavioral activity, coping and flexibility, and athlete burnout [28–30]. This recent literature supports a cautious test of rumination as one candidate pathway rather than assuming that a single trait-like score captures all competition-related repetitive thinking.

Theoretical framework and hypotheses

H_1) Higher injury anxiety is associated with lower psychological well-being

Current sport-injury evidence supports testing an inverse association between injury-related anxiety and psychological well-being without repeating the broader rehabilitation literature reviewed above. Contemporary consensus work emphasizes that psychological responses can remain relevant beyond tissue healing and return to participation [24]. Broader traumatic-injury evidence likewise indicates that anxiety, depression, and stress may persist after injury and complicate psychological recovery [31]. Evidence from Turkish athletes further shows meaningful variation in injury-anxiety dimensions according to injury history, competitive characteristics, pain-related fear, and coping-related processes [25–27]. These findings do not establish a causal effect of injury anxiety on well-being, but they provide a defensible basis for testing an inverse cross-sectional association. Accordingly, H_1 proposes that higher injury anxiety will be associated with lower psychological well-being.

H_2) Higher injury anxiety is associated with greater competition-related ruminative thinking

Threat appraisals can be accompanied by increased cognitive load, self-focused attention, and repetitive evaluative thinking [32]. In athletes, kinesiophobia and injury-related concerns have been examined alongside rumination, coping, and psychological flexibility [29], and recent sport-specific work indicates that ruminative states can be situational and performance-context dependent [16]. At the same time, the SCRS used here measures a generalized competition-related tendency and does not isolate post-competition processing or momentary injury-focused thoughts [14]. H_2 therefore tests whether higher injury anxiety is associated with greater generalized competition-related rumination, while recognizing that the operationalization may attenuate phase-specific associations.

H_3) Higher competition-related ruminative thinking is associated with lower psychological well-being

Repetitive negative thinking is associated with sustained negative affect and poorer psychological adjustment in broader psychological research [13, 33], and experimental evidence suggests that worry and rumination can prolong affective and physiological recovery following stress [34]. Quantitative athlete evidence points in the same direction. Derelioğlu et al., [30] reported a significant negative association between ruminative thinking and mental well-being in 1,326 sports high-school students (β=-0.1792, p<.001). Wang, [35] found that both brooding

and reflective rumination were negatively associated with well-being among female university athletes, and Kruger et al., [36] linked affective rumination with poorer general mental health in professional rugby players. These studies provide general athlete evidence rather than serious-injury-specific evidence. The injury-specific rationale is therefore theoretical: after a serious surgically treated injury, training and competition again expose the athlete to the possibility of re-injury, underperformance, loss of selection, and threats to competence and role continuity. Within the integrated model of response to sport injury, such appraisals can shape emotional and behavioral adjustment [8]. Competition-related repetitive thinking could therefore sustain injury-linked threat appraisals beyond the immediate competitive episode and plausibly relate to lower psychological well-being. H_3 accordingly proposes an inverse association in previously injured players while recognizing that a single generalized cross-sectional score may not capture phase-specific repetitive cognition.

H_4) Competition-related rumination is hypothesized to statistically mediate the association between injury anxiety and psychological well-being

H_4 tests competition-related rumination as a potential statistical mediator of the association between injury anxiety and psychological well-being. The proposed pathway is theoretically consistent with threat-appraisal and repetitive-thinking models, but it should be treated as a statistical hypothesis rather than an established temporal mechanism. Adjacent post-event-processing research outside sport indicates that self-focused attention and repetitive review of stressful events can sustain anxiety-related cognition and distort subsequent self-evaluation [37–43]. However, that literature does not establish that the SCRS captures the same phase-specific process in professional football. The SIAS is injury focused, whereas the SCRS assesses a generalized competition-related ruminative tendency at one assessment point. This theory-measurement distinction is therefore central to the interpretation of H_4: The mediation analysis evaluates whether the observed data are consistent with the proposed indirect pathway, but it cannot establish causal or temporal mediation in the present cross-sectional design.

Methods

Research design and mixed methods integration

The study used a sequential mixed-methods design with qualitative-first data collection and quantitatively driven hypothesis testing. The qualitative interviews were conducted first to document context-specific experiences of injury anxiety, repetitive cognition, rehabilitation, return to sport, and support; the subsequently collected survey tested prespecified associations and the mediation hypothesis in a broader professional-football sample. The sequence was therefore not explanatory in the conventional QUAN→ QUAL sense, because the interviews could not have been designed in response to later statistical findings. Instead, integration was planned for complementarity. Following Fetters et al., [44], connecting occurred through the 40 interview participants who also entered the quantitative sample, and merging occurred through joint displays and side-by-side meta-inferences. Formal building was intentionally limited because the quantitative instruments and hypotheses were prespecified [44, 45].

The substantive value of integration was defined a priori as the production of meta-inferences that neither strand could support alone. Both strands addressed injury anxiety, repetitive thinking, and psychological well-being, but at different levels: the survey estimated between-person associations among generalized scores, whereas the interview guide asked when and in which situations players experienced these phenomena, including the timing and triggers of repetitive injury-related thoughts in matches, during rehabilitation, and after return to play (Appendix A, items 4–9). Integration generated three distinct inferences. First, convergence linked the inverse SIAS-PWB association with interview domains of career continuity, role, identity, and belonging without treating those domains as mediators. Second, divergence showed that players could describe episodic injury-related

repetitive thinking even when generalized SCRS scores were not associated with SIAS or PWB; therefore, a null generalized path should not be equated with absence of context-bound rumination. Third, expansion identified communication, perceived club support, and role security as unmeasured variables for future quantitative models. Rehabilitation stage itself was not measured as a contemporaneous quantitative variable: all participants had completed formal rehabilitation, interviewees described rehabilitation and early return retrospectively, and only time since the most recent serious injury was entered as a covariate. Thus, the strands are integrated at sampling, construct-level interpretation, joint display, and meta-inference, while the limits of that integration are stated explicitly.

Participants and sampling

The qualitative dataset consists of semi-structured interview transcripts obtained from professional football players. A total of 40 interview transcripts were included in the qualitative analysis ($N=40$). For descriptive reporting only, complete demographic information was available for 33 participants ($n=33$). The remaining 7 interviewees had incomplete or missing background forms (e.g., age, years of football participation, and/or playing position) due to scheduling constraints at the time of interview, and therefore could not be included in the demographic summaries. Importantly, these 7 transcripts were retained in full for thematic analysis because the missingness concerned background descriptors rather than the substantive interview content. Accordingly, demographic statistics are presented on an available-case basis ($n=33$) without imputation, whereas qualitative thematic findings reflect the entire interview corpus ($N=40$). Within the subsample with complete demographic data ($n=33$), the mean age was 26.67 years (SD = 3.12; range:21–33), and the mean duration of football participation was 16.52 years (SD = 3.16; range:10–23). Positional distribution within this subsample was goalkeeper ($n=4$), defender ($n=15$), midfielder ($n=6$), and forward ($n=8$).

A purposive maximum variation sampling strategy was employed to enhance experiential diversity across key performance-relevant characteristics, including playing position, competitive league level, sport experience, and time elapsed since the most recent serious injury.

Following the qualitative phase, the quantitative survey was completed by 106 professional football players, including the 40 interview participants and an additional 66 players. Recruitment was constrained by access to a specialized professional-athlete population. No a priori SEM power analysis was conducted, and the sample should therefore not be presented as demonstrably powered for small indirect effects. The revised AMOS specification contained 33 observed indicators and nine latent variables (six first-order SIAS factors, a second-order SIAS factor, rumination, and psychological well-being), with 85 freely estimated parameters and 476 degrees of freedom. Thus, the N-to-free-parameter ratio (approximately 1.25:1) is below commonly cited 5:1 or 10:1 heuristic. Such ratios are not absolute adequacy criteria because SEM sample requirements depend on factor loadings, path magnitudes, model complexity, and distributional characteristics [46]. Nevertheless, $N = 106$ is modest for this specification, particularly for detecting small indirect effects. Results are therefore interpreted cautiously and supplemented with overlap-exclusion and covariate-adjusted robustness analyses.

The demographic characteristics of the quantitative sample are summarized as follows: Participants were distributed across age groups of 18–21 years ($n=22$; 20.8%), 22–24 years ($n=23$; 21.7%), 25–28 years ($n=23$; 21.7%), and 29 years, and above ($n=38$; 35.8%). Competitive league level included Super League ($n=14$; 13.2%), 1st League ($n=29$; 27.4%), 2nd League ($n=47$; 44.3%), and 3rd League ($n=16$; 15.1%). Playing positions were goalkeeper ($n=14$; 13.2%), defender ($n=29$; 27.4%), midfielder ($n=47$; 44.3%), and forward ($n=16$; 15.1%). Sport experience ranged from 1 to 3 years ($n=1$; 0.9%) to 16 years, and above ($n=47$; 44.3%), while time since the most recent serious injury was reported as 0–6 months ($n=31$; 29.2%), 7–12 months ($n=23$; 21.7%), and 1–3 years ($n=52$; 49.1%).

Data collection

Quantitative data collection procedure and measures

Quantitative data were collected using two modes of administration (online, and face-to-face) to maximize access to a geographically, and logistically constrained professional football population. Professional players were initially contacted through their clubs, and technical staff solely for the purpose of study announcement, and coordination; participation was entirely voluntary, and neither clubs nor technical personnel were informed about individual participation status or responses. It was explicitly communicated to all potential participants that their decision to participate or decline would have no institutional, contractual, or performance-related consequences.

Eligible players received study information detailing the purpose and scope of the research, voluntary participation, confidentiality protections, and the absence of institutional, contractual, or performance consequences. Quantitative survey responses were handled in de-identified form and were not disclosed to clubs, technical staff, or other unauthorized parties. Interview data were managed separately: audio recordings were used only for transcription and analytic purposes, and identifying information was removed from transcripts before analysis.

In the first phase, qualitative interviews were conducted between May and June 2025; quantitative data collection followed between July and August 2025. The online survey was administered through Google Forms. Its first page contained the informed-consent information, and participants could proceed only after electronically indicating consent. Face-to-face participants received the same study information and provided documented consent before completing the measures. The same confidentiality and voluntariness principles applied to both administration modes.

To address potential mode-related measurement effects, both online, and face-to-face administrations employed identical instruments, item ordering, and response formats. While formal measurement invariance testing across modes was not conducted due to sample size considerations, the use of standardized scales, and uniform administration procedures was intended to minimize response bias associated with mode of delivery. Data collection was completed within the overall study window of May-August 2025.

The survey package consisted of a brief demographic information form (e.g., age, gender, height, body weight, body mass index, marital status, and income status), and three standardized Likert-type instruments assessing psychological well-being, competition-related rumination, and sport injury anxiety.

Psychological well-being Psychological well-being was assessed with the eight-item Psychological Well-Being/Flourishing measure developed by Diener et al., [22] and adapted into Turkish by Telef [23]. The scale provides a global, unidimensional assessment of perceived positive functioning, including meaning, competence, optimism, and positive engagement. It is not a sport-specific instrument and does not provide separate scores for Ryff's six eudaimonic domains; accordingly, the present study interprets it only as a general psychological well-being measure.

All eight items are positively worded and rated on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree), yielding total scores from 8 to 56, with higher scores indicating greater psychological well-being. The Turkish adaptation has reported acceptable reliability and validity [23].

Sports competition rumination scale Competition-related rumination was assessed using the Turkish adaptation of the SCRS developed by Michel-Kröhler et al. [14] and adapted by Karafil and Pehlivan [47]. The Turkish version is unidimensional and contains six items assessing a generalized tendency toward repetitive negative thinking about competitive-sport problems. Items are rated on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree), producing scores from 6 to 30, with higher scores indicating greater competition-related rumination. The scale does not separately quantify rehabilitation-related, pre-competition, in-competition, or

post-competition episodes. This theory-measurement distinction was therefore retained explicitly when interpreting H2-H4 and the non-supported indirect pathway

Sport injury anxiety scale Injury anxiety was assessed using the SIAS developed by Rex and Metzler [5] and adapted into Turkish by Caz et al., [48]. The instrument is rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) and assesses multidimensional anxiety responses associated with sport injury. The Turkish adaptation contains 19 items across six factors: Fear of losing one's talent, fear of being perceived as weak, fear of suffering, fear of disappointment, fear of losing social support, and fear of re-injury.

Participants included in the injury anxiety assessment were professional football players who had experienced a medically diagnosed serious injury requiring surgical intervention, and who had completed the formal rehabilitation process prior to data collection. This inclusion criterion was applied deliberately to ensure that respondents had a shared, and clearly defined injury reference point, allowing injury-related anxiety to be assessed as a stable psychological disposition rather than an acute pain- or treatment-driven reaction. While this criterion may limit the generalizability of the findings to athletes with non-surgical or minor injuries, it was theoretically justified to enhance construct validity, and comparability of injury anxiety experiences within an elite sport context.

In line with the mixed-methods design, participant recruitment followed a purposive sampling logic aimed at maximizing variation across sport-relevant characteristics (e.g., playing position, competitive level, sport experience, and time since injury). Practical access constraints inherent to elite sport environments necessitated the use of availability-based recruitment channels (e.g., clubs, and technical staff) for initial contact; however, selection, and inclusion decisions were guided by predefined purposive criteria rather than by convenience alone.

Qualitative data collection procedure

Qualitative data were collected through semi-structured interviews guided by an interview protocol designed to elicit in-depth accounts of (a) injury experience, and appraisal, (b) the trajectory of injury-related anxiety, (c) competition-related ruminative thinking in training, and competitive contexts, (d) perceived impacts on psychological well-being, identity, and social functioning, and (e) perceived support needs, and available resources. Interviews were conducted between May and June 2025, each lasting approximately 40–60 min. All interviews were audio-recorded with participants' consent, transcribed verbatim, and anonymized through the removal of identifying information.

Participant recruitment combined availability-based access with purposive, maximum-variation selection criteria. Initial contact with professional football players was facilitated through clubs, and technical staff for logistical access only; inclusion decisions were guided by predefined purposive criteria aimed at maximizing experiential diversity across playing position, competitive level, sport experience, and time since injury. Thus, while access relied on availability, the analytic sample reflected a purposive/maximum-variation logic rather than convenience alone.

Eligible participants were professional football players in Türkiye aged 18 years, and older who had experienced a medically diagnosed long-term sports injury ($\geq$2 months) within the previous three years, had undergone surgical intervention, and had completed a formal rehabilitation process. Data were collected exclusively from professional athletes competing within the Turkish football league system. This criterion was applied deliberately to ensure a shared, and clearly defined injury reference point, allowing participants to reflect on injury anxiety, and related cognitive processes beyond acute pain or treatment phases. Although this approach may limit generalizability to athletes with minor or non-surgical injuries or to players from different national contexts, it was theoretically justified to enhance construct clarity, and comparability of post-injury psychological experiences within an elite sport environment.

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee for Social and Humanities Research of Ondokuz Mayıs University, Samsun/Türkiye (approval date: November 29, 2024; reference number: 2024−1059). Documented informed consent was

Table 1 Qualitative sample characteristics of professional football players ($N=40$ transcripts; $n=33$ with complete demographic data)

Characteristic	Value
Qualitative dataset (transcripts)	40
Demographic subsample	$n=33$
Age	Mean = 26.67; SD = 3.12; 21–33
Years of playing football	Mean = 16.52; SD = 3.16; 10–23
Position (n = 33)	Goalkeeper 4; Defender 15; Midfielder 6; Forward 8

Note: N refers to the total number of qualitative interview transcripts included in thematic analysis ($N=40$). n refers to the subset of interviewees with complete demographic background forms used for descriptive statistics ($n=33$). Demographic data were missing for 7 participants due to incomplete background forms at the time of interview (e.g., age, years of playing football, and/or playing position). These transcripts were retained for thematic analysis

Table 2 Quantitative demographic characteristics of the professional football players participating in the study ($n=106$)

Variable	Category	*n*	%
Age (years)	18–21	22	20.8
	22–24	23	21.7
	25–28	23	21.7
	29, and above	38	35.8
Club Level	Süper Lig	14	13.2
	1st League	29	27.4
	2nd League	47	44.3
	3rd League	16	15.1
Playing Position	Goalkeeper	14	13.2
	Defender	29	27.4
	Midfielder	47	44.3
	Forward	16	15.1
Sport Experience (years)	1–3	1	0.9
	4–7	5	4.7
	8–11	21	19.8
	12–15	32	30.2
	16, and above	47	44.3
Time Since Last Serious Injury	0–6 months	31	29.2
	7–12 months	23	21.7
	1–3 years	52	49.1
Total		**106**	**100.0**

obtained before participation. Online survey participants indicated consent electronically before accessing the questionnaires, whereas face-to-face participation and qualitative interviews followed documented in-person consent procedures.

Participant characteristics

Qualitative and quantitative participant characteristics are presented in Tables 1 and 2, respectively.

Data analysis

Qualitative data were analyzed using the Reflexive Thematic Analysis (RTA) approach as outlined by Braun and Clarke [49]. Analysis followed an iterative, and recursive process involving familiarization with the data, generation of initial codes, clustering codes into shared meaning patterns, development of candidate themes, refinement, and (re)naming of theme boundaries, and final reporting. Coding combined inductive, data-driven processes with a theoretically informed deductive orientation grounded in models of injury-related threat appraisal, attentional

regulation, and post-injury psychological adaptation. This approach supported the elucidation of recurring patterns, and processes linking injury anxiety, competition-related rumination, and psychological well-being, rather than the identification of causal mechanisms.

Consistent with reflexive thematic analysis (RTA), sample adequacy was evaluated in relation to the richness, diversity, and interpretive usefulness of the interview material rather than by applying a rigid saturation endpoint. Braun and Clarke, [50] caution against treating saturation as a universal quality criterion for reflexive thematic analysis, in which themes are interpretive analytic outputs rather than entities simply discovered until no new codes appear. The 40 interviews provided substantial experiential variation across position, competitive level, sport experience, and time since injury. This rationale concerns analytic adequacy and should not be interpreted as statistical representativeness of the full quantitative sample.

All coding and theme development were conducted by the first author, who had formal training in qualitative methodology. Reflexive memo-writing was used throughout to document analytic decisions and evolving interpretations. Trustworthiness was supported through analytic coherence, maintenance of an audit trail, reflexive notes and memos, and explicit consideration of deviant or non-conforming cases [51]. Reporting of the interview procedures and qualitative findings was additionally checked against the Consolidated Criteria for Reporting Qualitative Research (COREQ) reporting framework [52]. These procedures were used to strengthen transparency and reflexivity rather than to imply inter-rater objectivity, which would be inconsistent with the reflexive thematic analysis approach adopted here.

Quantitative statistical analysis and robustness checks

Descriptive statistics and preliminary analyses were conducted in SPSS version 25, and the primary latent-variable model was estimated in AMOS version 23 using maximum likelihood (ML). The final SEM contained 33 observed indicators and nine latent variables: six first-order SIAS factors, a second-order SIAS factor, rumination, and psychological well-being. The AMOS parameter summary reported 85 freely estimated parameters and 476 degrees of freedom. Structural paths were SIAS→rumination, SIAS→psychological well-being, and rumination→psychological well-being. Unstandardized B, SE, CR, p values, standardized coefficients (β), standardized total effects, and standardized indirect effects were used to document the structural decomposition. Composite reliability and AVE were recalculated from the standardized loadings of the final model. The primary AMOS output supplied a point estimate but no inferential confidence interval for the latent indirect effect; inferential mediation conclusions therefore relied on the point-estimate decomposition together with the 5,000-resample bootstrap robustness analyses reported in Supplementary Table S1.

Distributional assumptions were examined before SEM interpretation. Univariate diagnostics included skewness, kurtosis, Shapiro-Wilk tests, histograms, and Q-Q plots for composite scores; multivariate normality was evaluated with Mardia's statistics across the 33 observed indicators. Multivariate normality was not supported. ML was retained to preserve the prespecified latent measurement structure, but primary ML p values and fit indices were not interpreted in isolation. Instead, the stability of the substantive conclusions was examined against two supplementary observed-score analyses using 5,000 percentile bootstrap resamples. These analyses do not convert the primary latent model into a robust-ML model; rather, they provide an explicit sensitivity check on the direction of the focal associations and, especially, on the mediation conclusion under the observed distributional conditions. For model reproducibility, the final AMOS parameterization was reported directly from the final output rather than summarized as only a few selected residual correlations. The parameter summary contained 33 freely estimated regression weights, 10 covariance parameters, and 42 variance parameters, for 85 free parameters in total and 476 degrees of freedom. The retained covariance parameters represented within-construct residual dependence among rumination and psychological well-being indicators, as displayed in the final AMOS diagram (Fig. 1); no cross-construct residual covariance and no additional post hoc structural path was introduced solely to obtain statistical significance. Model fit was evaluated from the final specification using χ^2/df, TLI, IFI, CFI, and RMSEA. GFI and AGFI were not used to adjudicate model adequacy in the revised inferential summary.

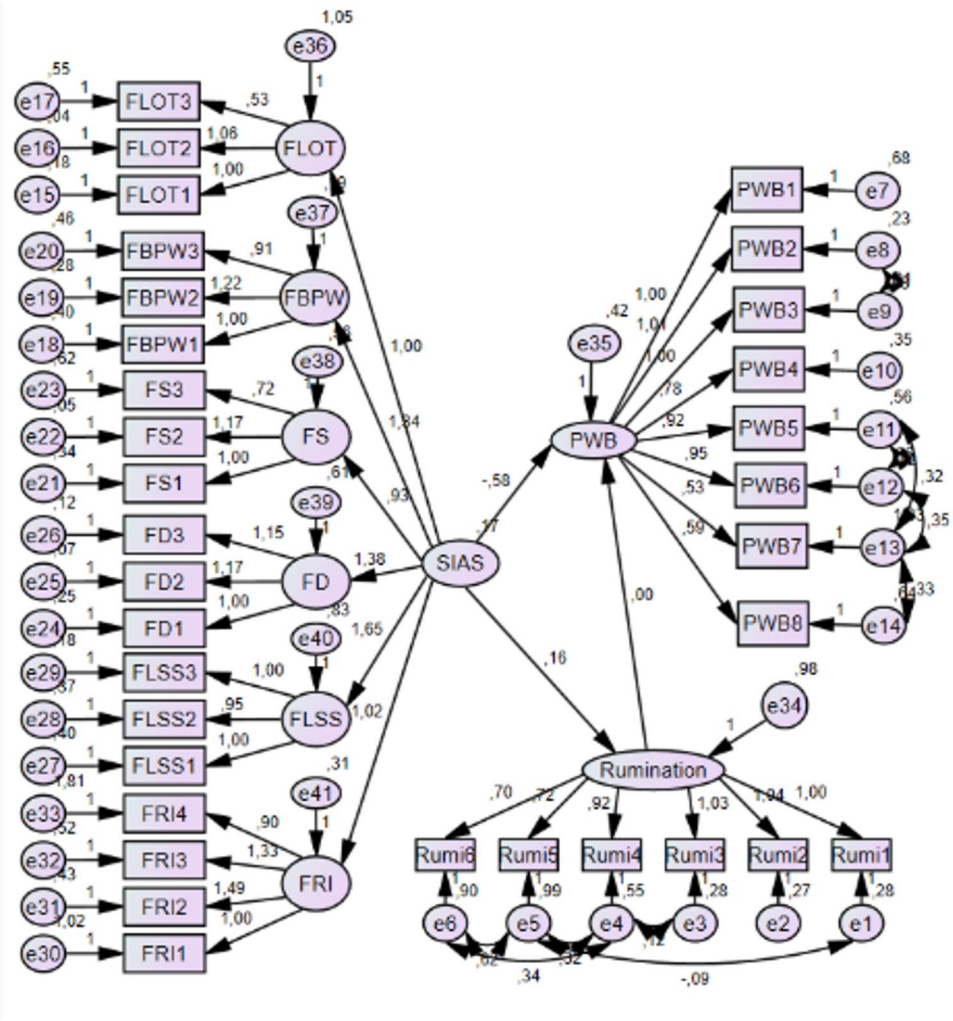


Fig. 1 Final AMOS path diagram showing the second-order SIAS measurement structure, focal structural paths, and the retained within-construct residual-covariance specification

For auditability, the parameter count and model-dimension information from the final AMOS output are summarized in Supplementary Table S2.

Multicollinearity was evaluated in the covariate-adjusted observed-score models using tolerance, variance inflation factors (VIF), and the condition index. The covariate-adjusted model controlled for age group, league level, playing position, sport experience, and time since the most recent serious injury; categorical variables were dummy coded. These covariates were selected because they capture major demographic, competitive, and injury-history differences available in the dataset that could plausibly be associated with injury anxiety or psychological well-being.

To address dependence created by overlap between the qualitative and quantitative strands, a sensitivity analysis excluded the 40 interview participants and retained the 66 quantitative-only participants. Re-estimating the 85-parameter latent model in $N = 66$ would have been statistically unstable; this analysis therefore used observed mean scale scores while preserving the same focal paths and applied 5,000 percentile bootstrap resamples. A parallel full-sample observed-score model adjusted for age group, league level, playing position, sport experience, and time since the most recent serious injury. These were not presented as substitutes for the latent SEM. Their inferential purpose was narrower: to test whether the direction of the SIAS-PWB association and the absence of a supported rumination-mediated indirect effect persisted under participant-overlap exclusion and covariate adjustment.

Qualitative-quantitative integration and meta-inference

Qualitative themes were mapped alongside the three focal quantitative constructs in joint displays. Integration was used to generate convergence, divergence, and expansion meta-inferences rather than to make the interview data validate p values or supply post hoc causal explanations. The qualitative strand clarifies the contexts in which the 40 interviewees experienced injury anxiety, repetitive cognition, and changes in well-being; the quantitative strand estimates associations in $N = 106$. Their combined interpretation therefore adds information unavailable from either strand alone while preserving the distinction between statistical evidence and contextual interpretation.

Results

Qualitative findings

Qualitative analysis yielded a three-part thematic architecture that contextualizes the quantitative pattern -namely the observed association between injury anxiety and well-being- and provides complementary perspectives on participants' experiences relevant to the non-significant mediating pathway involving rumination. The themes were: (1) cognitive-affective mapping of the injury threat, (2) context-dependent manifestations of rumination (i.e., "what if?" loops, and attentional management), and (3) fragilization of well-being, and sources of recovery. Each theme is presented below in relation to the quantitative hypotheses.

Theme 1: cognitive-affective mapping of the injury threat

Players described the injury moment, and its immediate aftermath not only in terms of physical pain but also as an abrupt threat appraisal linked to the possibility of career disruption. Key cognitive products at this stage were scenarios organized around uncertainty, loss of control, and the question, "Is my career ending?" Within the qualitative accounts, this threat appraisal provides an interpretive lens for the quantitative pattern in which injury anxiety was associated with lower well-being. Specifically, players' narratives suggested that anxiety-related threat appraisals were experienced alongside changes in mood, identity integrity, and social connectedness that were associated with lower perceived well-being. Importantly, these accounts also indicate that such impacts can be experienced even when participants did not explicitly articulate sustained, repetitive "what if?" thinking, which provides complementary context for the non-significant rumination pathway observed in the quantitative model.

This threat-appraisal pattern maps onto the integrated model of psychological response to sport injury, in which cognitive appraisals, and emotional reactions shape subsequent coping, and adjustment trajectories [8]. It is also consistent with stress-injury formulations highlighting attentional disruption, and heightened physiological arousal under perceived threat [6, 7].

Subtheme 1: uncertainty-shock, and career scenarios These accounts indicate that injury is not coded merely as a health event but as a risk register over "occupational continuity." In participants' narratives, this risk register was described as psychologically burdensome, and was often articulated through concerns about career interruption, contract uncertainty, and doubts about returning to prior performance levels -experiences that resonate with eudaimonic well-being dimensions such as purpose, agency, and perceived environmental mastery ([6]; [8]).

"I was basically in a state of uncertainty, and shock. Is my football career over, can I continue? Can I reach my old performance again? I had these question marks in my head, and honestly they upset me." (P4).

"Anger, and financial worry. My contract was about to end. Apart from the surgery costs, there was no support from the club. I felt 'discarded', and 'worthless.' I struggled with insomnia, and pessimism for four weeks." (P21).

Subtheme 2: fear of re-injury, and somatic hypervigilance Fear of re-injury was described as cautious engagement, more controlled movement, and heightened monitoring of bodily sensations. In these accounts, anxiety was experienced as an attentional load that can pull focus toward the body, and potential threat cues, shaping how players approach contact situations, and evaluate physical readiness. Rather than implying a direct causal pathway, these narratives suggest that such hypervigilance may be experienced as psychologically taxing in performance contexts, and may coincide with fluctuations in perceived well-being, and confidence during the return-to-play period [9, 53].

"After returning to the pitch, I had fear, and anxiety at first. I hesitated to go into tackles. I had a fear of getting injured again inside me. But day by day, over time, that fear decreased." (P5).

"There is no physical problem left. But I still have traces of what we call 'kinesiophobia' (fear of movement). I keep monitoring my body all the time." (P9).

Subtheme 3: experiences of loss, and devaluation (losing one's place, being discarded) These codes are theoretically consistent with SIAS subdimensions such as "fear of losing ability", and "fear of appearing weak." However, the qualitative accounts indicate that these fears are often experienced, and narrated in relational terms: Players described feeling unseen or unsupported by the club/technical staff, which coincided with perceived exclusion, and reduced belongingness. In this interpretive framing, threats to social support, and team membership were portrayed as psychologically taxing, and were described alongside deteriorations in confidence, and perceived well-being. Rather than implying temporal precedence or a specific mechanistic sequence, these narratives suggest that relational and belongingness concerns may co-occur with injury-related fears and lower perceived well-being [5].

"After an injury, you also fall out of favor in the team. Can I come back? Can I show the same performance? You got injured; you lost your spot. Can I get that jersey back? You feel more excluded." (P2).

"Because nobody from the club called, I felt discarded. This led to a serious loss of self-confidence." (P30).

Theme 2: context-dependent manifestations of rumination: the "What if?" loop, and attentional management

The non-significant association between injury anxiety, and rumination in the quantitative analysis can be interpreted as suggesting that rumination may not present as a uniformly persistent, high-intensity cognitive style across all players in a cross-sectional snapshot. The qualitative accounts instead portray ruminative thinking as context-, and phase-sensitive: It was most often described as emerging when (a) perceived risk escalates prior to injury, (b) during the first weeks of return-to-sport, and (c) during rehabilitation in response to uncertainty triggers. In contrast, during matches it was frequently narrated as brief, intermittent, and actively downregulated through routines, and attentional focusing strategies.

The juxtaposition of these findings raises a possible measurement-phenomenology mismatch. The quantitative instrument assesses a generalized competition-related ruminative tendency at one time point, whereas interviewees often described episodic and phase-bound experiences. This is an exploratory interpretation and not a tested explanation for the non-significant mediation result. The null mediation finding remains the empirical result.

Accordingly, the qualitative accounts motivate a future hypothesis that phase-sensitive variation may be attenuated when rumination is represented by a single cross-sectional aggregate score. Contemporary sport-rumination work is consistent with the possibility of situational fluctuation [14–16], but longitudinal or momentary assessment would be required to test this interpretation directly.

Subtheme 1: ruminative scenario-building, and contagious fear This excerpt suggests that the content of rumination can be organized less around past performance, and more around future-oriented threat scenarios, and that it may be triggered by vicarious threat cues circulating in the social environment (e.g., a teammate's injury narra-

tive). Rather than implying a deterministic "social contagion" mechanism, the accounts align with a social learning / vicarious appraisal framing in which others' experiences can function as salient threat information, making "what if?" scenarios more cognitively available in the period leading up to injury [12, 54].

"I fixated on it, and constructed it in my mind… Right before I got injured, psychologically: What if I get injured too? What if my cruciate ligament tears too?" (P2).

"I had never really thought about it… but my close friend had it. I remember thinking once: Could it happen to me too? … then I forgot." (P1).

Subtheme 2: Hesitation-behavioral cautiousness, and performance interference Players described "hesitation" as an in-between state characterized by cautious engagement, and momentary indecision in contact or high-demand actions. In their accounts, hesitation was perceived as increasing vulnerability during play (e.g., entering challenges "half-committed"), and was experienced as a micro-disruption that can pull attention away from the task, making fluent execution feel harder in the moment. Consistent with the broader theme of context-dependent rumination, this pattern was narrated as situational, and fluctuating rather than as a stable cognitive style shared uniformly across players [7].

"If you go in hesitantly, your chance of getting injured is higher… Those hesitations, and question marks in your head actually affect the process." (P2).

"…When you step onto the pitch again, there is a fear; you think: Should I put my foot in or not?" (P1).

Subtheme 3: regulatory strategies that interrupt rumination Participants frequently emphasized that maintaining morale, and sustaining motivation across the rehabilitation period helped them navigate the psychological strain of injury. In these accounts, regulation was narrated less as a single trait-like capacity, and more as a set of pragmatic coping moves, including (a) keeping morale high during difficult phases, (b) anchoring attention to visible rehabilitation progress, and concrete milestones, and (c) drawing on close social support (e.g., family, physiotherapist) as a stabilizing resource. These strategies were described as helping intrusive "question marks" lose intensity over time, thereby limiting how chronic or dominant ruminative thinking became for some players [21].

"Overall, in this process, your psychological state is very important… Keeping your morale high is very important. When you can't do that, it becomes very hard to get through this injury process." (P4).

"At first, I struggled, of course. But I realized day by day that I was getting better. This motivated me, and raised my morale… I had more positive feelings during the physiotherapy process." (P7).

"Sometimes I wanted to quit because of the pain, but the dream of returning to the pitch kept me going… I had to prove myself." (P35).

"[The people who helped me most were] my physiotherapist (my biggest mentor), my father (material, and emotional support), and my doctor (reassuring information)." (P35).

In mixed-methods terms, these accounts provide context for how some interviewed players described managing repetitive thoughts during rehabilitation. They do not demonstrate that regulation caused the non-significant mediation result or that rumination was absent. Rather, they identify potentially testable conditions -such as rehabilitation progress, attentional routines, and social support- that future longitudinal research could examine in relation to changes in rumination over time.

Theme 3: the fragilization of well-being, and sources of recovery

The third component of the thematic architecture portrays how players make sense of the fragility of well-being in the context of injury anxiety, and the resources they describe as supportive during recovery. Participants' accounts indicate that well-being in professional football is not limited to "feeling good," but also encompasses functional dimensions such as social belonging, role continuity, being able to move safely, and perceived control over the future. In mixed-methods terms, this theme offers an interpretive context for the quantitative finding of a direct association between injury anxiety and well-being, highlighting the lived domains that players associated with anxiety-related strain and the resources they linked to stabilization and re-engagement.

In line with eudaimonic well-being frameworks, players' accounts suggest that injury-related anxiety is often experienced alongside disruptions not only in affect but also in purpose, agency, and relational functioning-core domains of psychological well-being [18, 19]. From a motivation perspective, autonomy-supportive environments, and perceived relatedness are commonly theorized as buffers for well-being during injury, and rehabilitation, and participants' narratives resonate with this emphasis by foregrounding support, connection, and a sense of control as salient recovery resources [21].

Subtheme 1: social isolation, and affective collapse These accounts suggest that well-being strain is often narrated most visibly in relational, and purpose/role-related domains during the injury period. Rather than positioning injury anxiety as a direct causal "risk factor," participants' narratives portray anxiety as intertwined with social withdrawal, reduced participation in everyday life, and uncertainty about the future, and one's role, which were described alongside lowered mood, and a sense of psychological collapse. In this interpretive framing, feelings of being "left out," reduced contact, and perceived lack of emotional attunement from key others can coincide with deteriorations in perceived well-being [18, 20].

"It affected my social life negatively too… I couldn't go out. I couldn't see my friends. I was staying at home. This honestly pushed me into distress, and depression." (P4).

"My surgeon was very busy… He didn't even ask about my emotional state. This made me feel even more alone." (P39).

Subtheme 2: communication with the medical team, and continuity of care Differences in the quality of communication with treating clinicians -particularly the operating surgeon in the present excerpts- were narrated as meaningful for how players experienced the injury, and rehabilitation period. Rather than implying that communication determines the *pace* of recovery, participants' accounts suggest that brief, highly technical exchanges can be experienced alongside heightened loneliness, and reduced perceived control, whereas more attentive, and explanatory communication can be described as reassuring, and supportive. In this interpretive framing, communication quality appears to be linked to perceived self-efficacy, and clarity about the rehabilitation process, which may co-occur with fluctuations in perceived well-being [55, 56].

"The surgeon was very busy. Our dialogue was quick, and technical… He didn't even ask about my emotional state. This made me feel even more alone." (P30).

"My dialogue with my physician was very good. He was very attentive. He helped me a lot during this process." (P6).

Subtheme 3: recovery narratives, and psychological resilience Recovery narratives suggest that the relationship between injury-related anxiety, and well-being is often experienced as dynamic rather than static. Participants described that distress, and fear can be more salient in the early phase, yet may feel less dominant over time as players observe concrete signs of improvement, and re-establish a sense of agency. In this interpretive framing, resilience is expressed through (a) time-linked attenuation of fear, (b) motivation derived from visible rehabilitation progress, and (c) a renewed commitment to "fighting through" the process when faced with uncertainty.

"…Over time it passed… Right now, I don't feel something like that." (P2).

"At first, I struggled, of course. But I realized day by day that I was getting better. This motivated me, and raised my morale…" (P7).

In mixed-methods terms, these accounts are placed alongside the mediation result as complementary context. They suggest that some interviewed players experienced anxiety- and rumination-related cognitive load as episodic and responsive to changing recovery conditions, but this pattern was not tested as an explanation for the non-significant indirect effect. The qualitative material therefore generates a future hypothesis rather than a post hoc causal account.

Aligning the theme-code-subcode architecture with the quantitative hypotheses (codebook summary)

Figure 2 summarizes the theme-subtheme-code architecture and its connections with the quantitative constructs. The figure is descriptive and interpretive: It shows how injury anxiety, rumination, and psychological well-being appeared in the interview accounts without implying that qualitative coding confirmed the statistical hypotheses.

Joint displays, and meta-inferences

Table 3 brings the quantitative findings and qualitative themes into a joint display. The integration places statistical associations alongside interview experiences to identify areas of convergence, divergence, and future inquiry. It does not use the qualitative data to explain why a path was statistically significant or non-significant, and it does not convert contextual themes into quantitatively established mechanisms.

Quantitative results

Measurement properties, structural paths, and fit indices for the revised latent-variable model are reported in Tables 4–6. Figure 3 summarizes the structural coefficients, and Fig. 3 illustrates the AMOS specification, including the second-order SIAS measurement structure.

All first-order constructs showed composite reliability above 0.70 in the final structural model, and all freely estimated first-order indicator loadings were statistically significant ($p \leq .005$; most $p < .001$). Psychological well-being showed CR=0.85 and AVE=0.42, with standardized item loadings from 0.41 to 0.83; Fear of Re-injury showed CR=0.76 and AVE=0.46, with loadings from 0.43 to 0.85. These two factors therefore retained weaker-than-desired convergent validity despite acceptable composite reliability. Rumination showed $\alpha = 0.917$, CR=0.90, and AVE=0.61, while the remaining first-order SIAS factors showed CR=0.81-0.96 and AVE=0.59-0.88. Importantly for the second-order model, standardized SIAS loadings were FLOT=0.378, FBPW=0.788, FS=0.459, FD=0.595, FLSS=0.604, and FRI=0.610. Every freely estimated non-marker higher-order path was

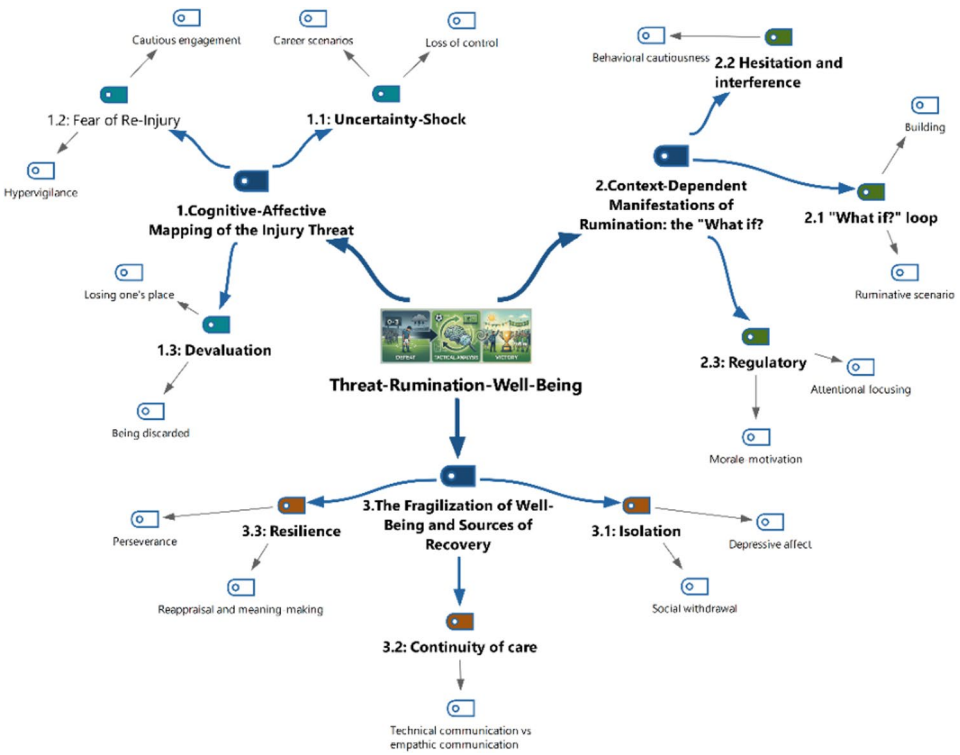


Fig. 2 Theme-subtheme-code architecture aligned to QUAN variables

Table 3 Integration of quantitative findings, and qualitative themes to generate mixed-methods meta-inferences

Hypothesis/Path	Quantitative Result	Qualitative Evidence (Themes)	Meta-Inference	Practice Implications
H_1: SIAS → PWB (negative)	Supported in primary SEM (B = −0.581, *p*=.029)	Themes 1 & 3: uncertainty, identity threat, isolation, loss of social/institutional support	The primary SEM supported an inverse SIAS-PWB association. Interview accounts illustrate how some players experienced uncertainty, role disruption, and reduced belonging; these contextual observations are not tested mechanisms.	Consider psychological screening and clear communication about rehabilitation and role continuity; these are practice-oriented implications, not tested intervention effects.
H_2: SIAS → Rumination (positive)	Not supported in primary SEM (B = 0.162, *p*=.566)	Theme 2: situational, and phase-specific triggering of rumination; active regulation	H_2 was not supported in the primary SEM. Interview accounts suggest that repetitive thoughts may be intermittent and phase-sensitive, but this is an exploratory interpretation rather than confirmation of the null path.	Use phase-sensitive assessment in future research and avoid assuming that generalized rumination represents in-match or post-event cognition.
H_3: Rumination →PWB (negative)	Not supported in primary SEM (B = 0.002, *p*=.976)	Themes 2–3: brief, regulated ruminative interruptions; stronger impacts from isolation, and identity disruption	H_3 was not supported. Qualitative material describes variable salience of repetitive thinking and coping routines, but it does not establish why the quantitative association was non-significant.	Target rumination selectively when clinically or functionally salient; combine this with broader support rather than treating rumination as the established mechanism.
H_4: SIAS →Rumination → PWB (indirect)	Primary B<0.001; βind=0.000; primary CI/p unavailable; both bootstrap CIs crossed zero.	Theme 2: phase-sensitive rumination; Themes 1 & 3: uncertainty, role, belonging, and support.	No supported generalized-rumination mediation; qualitative findings generate phase-sensitive hypotheses rather than explanations of the null path.	Test phase-specific rumination and alternative mediators longitudinally.

Note: Joint display integration generates convergence, divergence, and expansion meta-inferences. Qualitative themes are exploratory and do not validate p values or establish causality. Primary AMOS provided a near-zero indirect point estimate only; bootstrap inference is reported in Supplementary Table S1

Table 4 First-order measurement properties and second-order SIAS measurement evidence

Construct / Subscale	Factor loadings	Cronbach's alpha	CR	AVE
SIAS: Fear of Losing One's Talent (FLOT)	0.62–0.99	0.878	0.89	0.74
SIAS: Fear of Being Perceived as Weak (FBPW)	0.69–0.85	0.809	0.81	0.59
SIAS: Fear of Suffering (FS)	0.61–0.98	0.832	0.85	0.67
SIAS: Fear of Disappointment (FD)	0.89–0.98	0.957	0.96	0.88
SIAS: Fear of Losing Social Support (FLSS)	0.87–0.94	0.922	0.92	0.80
SIAS: Fear of Re-injury (FRI)	0.43–0.85	0.746	0.76	0.46
Psychological Well-Being (PWB; single-factor)	0.41–0.83	0.851	0.85	0.42
Rumination (single-factor)	0.59–0.89	0.917	0.90	0.61

Note: Factor loadings are standardized estimates from the final structural model. CR and AVE were recalculated from these standardized loadings. CR=Composite Reliability; AVE=Average Variance Extracted. First-order CR values exceeded 0.70, while PWB and FRI retained AVE<0.50 as convergent-validity limitations. Second-order SIAS evidence: FLOT β = 0.378 (marker; unstandardized B fixed at 1.000), FBPW β = 0.788 (B = 1.338, SE=0.440, *p*=.002), FS β = 0.459 (B=0.925, SE=0.352, *p*=.009), FD β = 0.595 (B = 1.378, SE=0.462, *p*=.003), FLSS β = 0.604 (B = 1.655, SE=0.557, *p*=.003), and FRI β = 0.610 (B = 1.021, SE=0.378, *p*=.007). Higher-order SIAS CR≈0.75 and AVE≈0.34. Thus, the higher-order construct showed acceptable composite reliability but limited convergent variance ([57, 58])

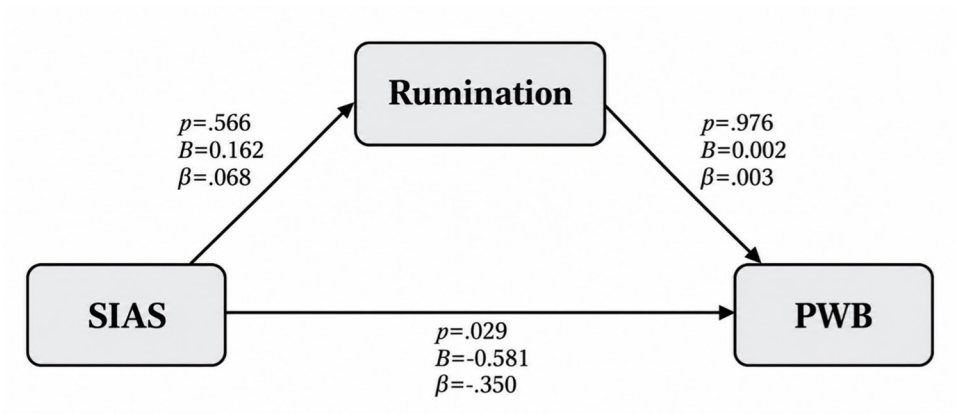


Fig. 3 Primary structural model with revised unstandardized regression weights (B), p values, and standardized coefficients (β)

significant (p=.002-0.009). The higher-order SIAS construct showed CR≈0.75 but AVE≈0.34, indicating acceptable composite reliability alongside limited higher-order convergent variance; this limitation is carried forward in the interpretation of structural SIAS effects.

Detailed second-order SIAS regression weights, standard errors, critical ratios, significance levels, and standardized loadings are provided in Supplementary Table S3.

In the primary SEM, SIAS was not significantly associated with rumination (B = 0.162, SE = 0.282, CR = 0.574, p=.566; β = 0.068). SIAS was significantly and inversely associated with psychological well-being (B=-0.581, SE = 0.265, CR=-2.188, p=.029; β=-0.350), whereas rumination was not associated with psychological well-being (B = 0.002, SE = 0.074, CR = 0.030, p=.976; β = 0.003). The standardized total SIAS→PWB effect was β=-0.349, almost identical to the direct effect of β=-0.350, because the standardized indirect effect rounded to 0.000. Thus, H1 was supported in the primary SEM, whereas H_2 and H_3 were not supported; the effect decomposition provided no point-estimate evidence that rumination transmitted the SIAS-PWB association.

The primary AMOS indirect point estimate was approximately zero (B < 0.001; standardized indirect effect=0.000), but the primary output did not provide an inferential bootstrap confidence interval or p value for that indirect effect. H4 therefore was not treated as formally tested by the primary indirect point estimate alone. Instead, mediation inference was based on convergence between the near-zero primary decomposition and the two supplementary bootstrap analyses, both of which produced indirect-effect confidence intervals containing zero. Taken together, these analyses did not support the hypothesized rumination-mediated pathway, while leaving open the possibility that more phase-sensitive forms of repetitive cognition may operate in other temporal contexts.

For transparent effect decomposition, the primary direct, indirect, and total SIAS-rumination-PWB effects are presented together in Supplementary Table S4.

The final model yielded $\chi^2(476) = 735.771$, p<.001 and $\chi^2/df = 1.546$. Incremental and error-of-approximation indices were TLI=0.902, IFI=0.907, CFI=0.907, and RMSEA=0.072. These indices support an acceptable but not unequivocal fit profile, particularly given the modest N relative to 85 free parameters and the violation of multivariate normality. The revised inferential summary therefore does not rely on GFI or AGFI and interprets model adequacy across the retained fit indices together with measurement quality and robustness analyses (Table 6).

Normality diagnostics showed statistically significant Shapiro-Wilk tests for most composite variables, although composite skewness and kurtosis were generally within ±2. At the indicator level, multivariate normality was not supported (Mardia multivariate skewness = 503.586, $\chi^2(6545) = 8896.681$, p<.001; multivariate kurtosis = 1273.435, CR = 12.685, p<.001). Accordingly, primary ML inference was interpreted cautiously and triangulated with the bootstrap robustness analyses. Multicollinearity was not evident in the adjusted models: tolerance values were ≥0.539, VIF values were ≤1.857, and the maximum condition index was 6.57 (Supplementary Tables S5-S6).

The overlap-exclusion sensitivity analysis ($N = 66$) produced a deliberately conservative robustness test because it removed every participant who also contributed qualitative data. SIAS was positively associated with rumination (β = 0.243, SE=0.121, 95% CI [0.001, 0.485], p=.049), whereas its association with psychological well-being remained negative but was attenuated and non-significant (β=-0.190, SE=0.127, 95% CI [-0.445, 0.064], p=.140); rumination was not associated with psychological well-being (β = 0.096, p=.452). Most importantly for the mediation claim, the indirect effect remained non-significant (β = 0.023, 95% bootstrap CI [-0.031, 0.119]). Thus, exclusion of the qualitative subsample changed the significance of some direct paths but did not generate evidence for the hypothesized indirect pathway.

In the full-sample covariate-adjusted model ($N = 106$), controlling for age group, league level, playing position, sport experience, and time since the most recent serious injury, the inverse SIAS-PWB association remained significant (β=-0.295, SE=0.089, 95% CI [-0.473, −0.118], p=.001). The adjusted SIAS→rumination path (β = 0.072, p=.470), rumination→PWB path (β=-0.002, p=.981), and indirect effect (β < 0.001, 95% bootstrap CI [-0.019, 0.036]) were not significant. The two robustness analyses therefore converge most clearly on one conclusion: a rumination-mediated indirect effect was not supported. The direct SIAS-PWB association was less stable because it persisted after covariate adjustment but not after reduction to $N = 66$.

Discussion

The central contribution of this study is not confirmation of a rumination-mediated mechanism, but a bounded account of how injury anxiety, generalized competition-related rumination, and psychological well-being co-occur in professional football. The mixed-methods joint display contributes more than parallel presentation: convergence connects the inverse SIAS-PWB association with interview domains of career continuity, identity, and belonging; divergence shows that episodic repetitive thoughts can be described even when generalized rumination scores are statistically unrelated to SIAS or PWB; and expansion identifies relational and organizational variables for future models. Quantitatively, H_1 was supported in the primary latent model, H_2 and H_3 were not, and the near-zero primary indirect decomposition together with two bootstrap robustness analyses did not support H_4. The direct SIAS-PWB association was replicated after covariate adjustment but not in the smaller $N = 66$ analysis, so the most defensible conclusion is an inverse full-sample association rather than a universally stable effect.

The inverse association between injury anxiety and psychological well-being is theoretically coherent with contemporary sport-injury research. Consensus and systematic evidence increasingly characterize injury as a biopsychosocial transition in which threat appraisal, fear of re-injury, uncertainty, and psychological readiness remain relevant beyond physical healing [4, 9, 24]. Meta-analytic evidence from traumatic injury research likewise indicates that post-injury anxiety, depression, and stress can persist and complicate recovery [31]. Within the present study, Themes 1 and 3 and the qualitative architecture summarized in Fig. 2 add experiential depth to this literature: Interviewees described uncertainty about career continuity, fear of re-injury, loss of control, social isolation, and concerns about role security. As represented in Table 3, these accounts should be read as contextual descriptions of the interviewed players rather than as causal mechanisms explaining the Table 5 path. This distinction is especially important because the cross-sectional model cannot establish whether injury anxiety precedes lower well-being, whether lower well-being increases vulnerability to injury-related anxiety, or whether both are shaped by unmeasured contextual factors.

The non-significant rumination findings are equally informative because they identify a boundary condition for the proposed model. The SCRS assesses a generalized competition-related tendency, whereas the interviews repeatedly located repetitive thinking within particular phases of rehabilitation, return to sport, pre-competition anticipation, or brief in-match episodes. Contemporary sport research similarly suggests that rumination can vary with goals, situational demands, and state-like experiences [14–16], and recent work in elite and developing athletes links ruminative dispositions with subjective performance, coping, flexibility, and well-being-related

Table 5 Structural equation model regression coefficients with standardized effect estimates

Outcome	Predictor	B (unstandardized)	SE	CR	β	*p*
Rumination	SIAS	0.162	0.282	0.574	0.068	0.566
PWB	SIAS	-0.581	0.265	-2.188	−0.350	0.029*
PWB	Rumination	0.002	0.074	0.030	0.003	0.976
PWB	SIAS →Rumination → PWB (indirect)	<0.001	-	-	0.000	n/a†

*p<.05. B=unstandardized AMOS regression weight; β=standardized coefficient; SE=standard error; CR=critical ratio; PWB=psychological well-being; SIAS=Sport Injury Anxiety Scale. †Primary AMOS reported the indirect point estimate but no inferential CI/p. Standardized total SIAS→PWB β=-0.349; direct β=-0.350; indirect=0.000. Bootstrap indirect-effect inference is reported in Supplementary Table S1

outcomes rather than with a single uniform pathway [28–30, 59]. Experimental and psychophysiological research also indicates that repetitive negative thinking can prolong recovery from stress [34]. Thus, the absence of mediation in Table 5 should not be interpreted as evidence that repetitive cognition is irrelevant to injured athletes; rather, it indicates that the specific generalized construct measured here did not statistically transmit the injury anxiety-well-being association in this sample. This interpretation is strengthened by distinguishing sport competition rumination from adjacent post-event-processing literature. Studies in social-anxiety contexts have shown that self-focused attention and repetitive post-event review can sustain negative self-evaluation and anxiety-related cognitive cycles [37, 38, 40–43]. These findings are theoretically relevant because they demonstrate that repetitive cognition can be temporally anchored to a stressful event; however, they should not be treated as direct evidence for the SCRS or for professional football. The present results therefore favor a phase-sensitive measurement agenda rather than a post hoc explanation of the null indirect effect. Repeated-measures, ecological momentary assessment, and rehabilitation-stage designs would be better positioned to determine whether injury-focused rumination emerges transiently even when a generalized between-person score is weakly related to well-being.

The mixed-methods component also suggests that alternative contextual processes deserve direct testing. As summarized in Table 3, interviewees repeatedly described role continuity, belonging, communication with medical and coaching staff, and perceived support as salient elements of the injury experience. These observations align with the integrated model of response to sport injury and with self-determination theory, both of which emphasize the interaction between appraisal, coping, social context, competence, autonomy, and relatedness [8, 21]. Recent athlete research also links basic psychological needs with sport-related motivational functioning [60], while systematic evidence indicates that psychological interventions can improve mental well-being in elite athletes [61]. Evidence that hope and social support are associated with rehabilitation beliefs and subjective well-being in injured athletes further supports the relevance of this relational context [55], while research on athletic mental energy indicates that athlete well-being can be linked to broader motivational and psychological-resource pathways [62]. These converging literatures make identity threat, basic psychological need satisfaction, attentional control, psychological flexibility, and perceived institutional support plausible candidates for future mediation or moderation models. They remain candidate processes, however, because none was directly quantified as an explanatory mechanism in the present structural model.

The measurement and robustness evidence both supports and constrains interpretation. At the first-order level, all freely estimated indicator loadings were significant and composite reliability exceeded 0.70, but PWB (AVE=0.42) and FRI (AVE=0.46) retained weaker-than-desired convergent validity. At the second-order level, SIAS loadings ranged from β=0.378 to 0.788; all freely estimated higher-order paths were significant, yet the higher-order construct had CR≈0.75 and AVE≈0.34. Thus, the six injury-anxiety dimensions covaried sufficiently to support a broad higher-order score, but the low higher-order AVE cautions against treating that score as a uniformly strong common factor. The structural SIAS→PWB path (β=-0.350) should therefore be interpreted alongside this measurement limitation. Model fit was acceptable on χ^2/df, TLI, IFI, CFI, and RMSEA, but N=106 was modest relative to 85 free parameters and multivariate normality was violated. Conversely, multicollinearity was not material, and the indirect effect remained unsupported in both bootstrap robustness analyses. This pattern supports restraint: the absence of a supported generalized-rumination mediation pathway is more consistent across

Table 6 Selected fit indices for the final latent-variable model

Fit index	Value	Common guideline
χ^2/df	1.546	<3.0 (good)
TLI	0.902	≥0.90 (acceptable)
IFI	0.907	≥0.90 (acceptable)
CFI	0.907	≥0.90 (acceptable)
RMSEA	0.072	≤0.08 (acceptable)

analyses than the exact magnitude or statistical certainty of the direct association. Taken together, the study shifts the theoretical question from whether rumination is a universal bridge between injury anxiety and psychological well-being to when, for whom, and in which phase repetitive cognition becomes psychologically consequential. The integration of Tables 1–6; Figs. 1–3 , and Supplementary Tables S1-S6 supports a coherent but appropriately bounded account: Injury anxiety and lower psychological well-being were associated in the full sample, the hypothesized generalized rumination mediator was not supported, and the qualitative strand identified contextually meaningful experiences that should be converted into testable longitudinal hypotheses rather than treated as explanations already established by the data. This combination of confirmatory restraint, robustness testing, and mixed-methods contextualization is the principal interpretive strength of the study.

Conclusion

The primary latent SEM identified an inverse SIAS-PWB association, and the covariate-adjusted full-sample analysis reproduced that direction and statistical significance. Generalized competition-related rumination was not associated with SIAS or PWB in the primary model, and the standardized total SIAS→PWB effect (β=-0.349) was essentially the same as the direct effect (β=-0.350) because the standardized indirect effect rounded to 0.000. Both supplementary bootstrap analyses also produced indirect-effect confidence intervals containing zero. The $N=66$ overlap-exclusion analysis preserved the negative direction of the SIAS-PWB association but not its significance. Accordingly, the evidence supports an associational injury-anxiety/well-being finding and does not support causal or temporal mediation through generalized competition-related rumination.

The qualitative findings add depth by showing how interviewed players described career uncertainty, identity and role concerns, fear of re-injury, social belonging, and perceived support during rehabilitation and return to sport. These themes are exploratory contextual insights rather than quantified mechanisms. The combined findings support future longitudinal and phase-sensitive research that distinguishes generalized rumination from injury- and stage-specific repetitive cognition and directly tests alternative contextual pathways.

Theoretical contribution

The theoretical contribution is threefold. First, the study distinguishes generalized competition-related rumination from phase-specific repetitive cognition, clarifying a boundary between construct theory and measurement. Second, the structural decomposition is unusually informative: the standardized total SIAS →PWB effect (β=-0.349) was virtually identical to the direct effect (β=-0.350), while the standardized indirect effect rounded to 0.000; supplementary bootstrap confidence intervals likewise included zero. This pattern argues against a generalized-rumination mediation account in this sample without implying that all repetitive cognition is irrelevant. Third, integration generates testable meta-inferences that neither strand yields alone: convergence around anxiety-related threats to well-being, divergence between episodic interview accounts and generalized SCRS scores, and expansion toward identity threat, basic psychological needs, attentional regulation, communication, and perceived institutional support.

Practice implications

The practice-oriented implications summarized in Table 3 can be implemented without assuming causality. Clubs may consider (1) standardized psychological screening for injury-related anxiety at predefined rehabilitation milestones, such as early rehabilitation and pre-return-to-play; (2) scheduled interdisciplinary check-ins involving medical staff, sport-psychology personnel, and relevant coaching staff to clarify recovery expectations and role continuity; (3) explicit communication about selection, reintegration, and return-to-play criteria; and (4) a documented referral pathway when persistent anxiety interferes with rehabilitation participation, confidence, sleep, or return-to-play readiness. Because rumination was not supported as a mediator, the present data do not justify prioritizing a universal rumination-focused intervention over broader psychological and organizational support. These recommendations are practice-oriented propositions to be evaluated prospectively, not intervention effects demonstrated by this study.

Limitations and future research

Several limitations constrain interpretation. First, the quantitative component was cross-sectional, so temporal ordering and causal mediation cannot be established. Second, $N = 106$ was modest for a model with 85 free parameters, including 10 covariance parameters, and no a priori SEM power analysis was performed; small direct and indirect effects may therefore be imprecisely estimated. Third, multivariate normality was violated while the primary latent model used conventional ML. The revised analysis addresses this concern by making the distributional violation explicit and by triangulating conclusions with 5,000-resample bootstrap observed-score robustness analyses, but those analyses are not equivalent to a robust latent estimator and do not eliminate the limitation. Fourth, the primary AMOS output did not provide an inferential bootstrap confidence interval for the latent indirect effect; the formal mediation conclusion therefore rests on the near-zero primary decomposition plus two supplementary bootstrap analyses. Fifth, the qualitative and quantitative samples overlapped because all 40 interviewees were included in $N = 106$; the $N = 66$ analysis addressed this dependence but reduced statistical precision. Sixth, background information was incomplete for 7 of 40 interviewees, limiting qualitative subgroup description. Seventh, rehabilitation stage was not measured contemporaneously: all participants had completed formal rehabilitation, time since injury was recorded only in broad categories, and interview accounts of rehabilitation were retrospective. Eighth, mixed-methods integration occurred through connecting, construct alignment, joint display, and meta-inference rather than through building the quantitative instrument from qualitative findings.

Measurement limitations also require explicit attention. The SCRS assesses generalized competition-related rumination and may not capture rehabilitation-specific, pre-competition, in-competition, or post-competition fluctuations. PWB showed AVE=0.42 and FRI AVE=0.46 despite acceptable CR. More importantly for the second-order specification, SIAS higher-order loadings ranged from $\beta = 0.378$ to 0.788 and yielded CR≈0.75 but AVE≈0.34; the common injury-anxiety factor therefore explains a limited proportion of variance across its six first-order dimensions. The Turkish PWB adaptation was not originally validated in a professional-athlete sample and is a global rather than sport-specific well-being measure. All focal quantitative variables were self-reported, formal measurement invariance across online and face-to-face administration was not tested, and the supplementary robustness analyses used observed mean scores rather than the full latent measurement structure.

Future studies should preregister simpler or cross-validated latent models in larger multisite samples, use robust latent estimators (e.g., robust ML where available) or bootstrap procedures directly at the latent-model level, and report the complete higher-order measurement structure and residual-covariance specification. Longitudinal or ecological momentary designs should distinguish rehabilitation-related, pre-competition, in-competition, and post-competition repetitive thinking and directly measure rehabilitation phase. Future models should also test alternative mediators or moderators suggested by the integrated findings, including psychological flexibility,

coping, identity threat, attentional control, basic psychological need satisfaction, communication quality, and perceived institutional support.

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Data availability Data were collected from a relatively small and potentially identifiable professional-athlete population. Direct identifiers were not retained in the quantitative analytic dataset. Qualitative interviews were audio-recorded with consent, but recordings were used only for transcription and analysis; transcripts were de-identified through removal of identifying information before thematic analysis. Results are reported in aggregate form, and quotations are presented without information intended to permit direct identification of individual players. Participant-level quantitative data, interview audio files, and full verbatim transcripts are not publicly deposited because the consent and confidentiality procedures promised that participant data would not be disclosed to unauthorized third parties or institutions. The manuscript, tables, joint display, and supplementary diagnostics therefore provide the shareable aggregate evidence used to evaluate the analyses while preserving the confidentiality commitments made to participants.

Declarations

Ethics committee statements This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee for Social and Humanities Research of Ondokuz Mayıs University, Samsun/Türkiye (approval date: November 29, 2024; reference number: 2024-1059). The approved protocol covered the sequential qualitative interview and quantitative survey components in the same professional-football population. Documented informed consent was obtained before data collection; online survey participants indicated consent electronically before accessing the questionnaires, while face-to-face participation and interviews followed documented in-person consent procedures. No procedure beyond the approved study protocol was introduced during data collection.

Informed consent statement Documented informed consent was obtained from all participants before participation. Online survey participants reviewed the consent information on the first survey page and electronically indicated consent before proceeding. Face-to-face participants and interviewees completed the consent process before data collection. Participants were informed about the study purpose and procedures, voluntary participation, the right to withdraw without adverse consequences, confidentiality protections, and the scientific use of their data.

Artificial intelligence statement Artificial intelligence-based tools were used for language editing and revision support. They were not used as autonomous decision-makers.

Competing interests The authors declare no competing interests.

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References

1. López-Valenciano A, Ruiz-Pérez I, Garcia-Gomez A, Vera-Garcia FJ, De Ste Croix M, Myer GD, Ayala F. Epidemiology of injuries in professional football: A systematic review, and meta-analysis. Br J Sports Med. 2020;54(12):711–8. https://doi.org/10.1136/bjsports-2018-099577.
2. Gurău TV, Gurau G, Voinescu D, Anghel L, Onose G, Iordan D, Munteanu C, Onu I, Musat C. Epidemiology of injuries in men's professional, and amateur football (Part I). J Clin Med. 2023;12(17):5569. https://doi.org/10.3390/jcm12175569.
3. Deokar R. Psychological effects of sports injuries on athletes. Int J Multidisciplinary Res. 2025;7(3):1–11. https://doi.org/10.36948/ijfmr.2025.v07i03.44850.
4. Ambegaonkar JP, Jordan M, Wiese KR, Caswell SV. Kinesiophobia in injured athletes: A systematic review. J Funct Morphology Kinesiol. 2024;9(2):78. https://doi.org/10.3390/jfmk9020078.
5. Rex SL, Metzler JN. Development of the Sport Injury Anxiety Scale. Meas Phys Educ Exerc Sci. 2016;20(3):146–58. https://doi.org/10.1080/1091367X.2016.1188818.
6. Andersen MB, Williams JM. A model of stress, and athletic injury: Prediction, and prevention. J Sport Exerc Psychol. 1988;10(3):294–306. https://doi.org/10.1123/jsep.10.3.294.
7. Williams JM, Andersen MB. Review, and critique of the stress, and injury model. J Appl Sport Psychol. 1998;10(1):5–25. https://doi.org/10.1080/10413209808406375.
8. Wiese-Bjornstal DM, Smith AM, Shaffer SM, Morrey MA. An integrated model of response to sport injury: Psychological, and sociological dynamics. J Appl Sport Psychol. 1998;10(1):46–69. https://doi.org/10.1080/10413209808406377.
9. Ardern CL, Taylor NF, Feller JA, Webster KE. A systematic review of the psychological factors associated with returning to sport following injury. Br J Sports Med. 2013;47(17):1120–6. https://doi.org/10.1136/bjsports-2012-091203.
10. Glazer DD. Development, and preliminary validation of the Injury-Psychological Readiness to Return to Sport (I-PRRS) scale. J Athl Train. 2009;44(2):185–9. https://doi.org/10.4085/1062-6050-44.2.185.
11. Webster KE, Feller JA. Factors associated with psychological readiness to return to sport after anterior cruciate ligament reconstruction surgery. Am J Sports Med. 2018;46(7):1545–50. https://doi.org/10.1177/0363546518773757.
12. Brosschot JF, Gerin W, Thayer JF. The perseverative cognition hypothesis: A review of worry, prolonged stress-related physiological activation, and health. J Psychosom Res. 2006;60(2):113–24. https://doi.org/10.1016/j.jpsychores.2005.06.074.
13. Watkins ER, Roberts H. Reflecting on rumination: Consequences, causes, mechanisms, and treatment of rumination. Behav Res Ther. 2020;127:103573. https://doi.org/10.1016/j.brat.2020.103573.
14. Michel-Kröhler A, Krys S, Berti S. Development, and preliminary validation of the sports competition rumination scale (SCRS). J Appl Sport Psychol. 2023;35(2):265–83. https://doi.org/10.1080/10413200.2021.1961921.
15. Michel-Kröhler A, Krys S, Berti S. Rumination in the context of individual goal achievement: A cross-sectional study using a multisport sample. J Appl Sport Exerc Psychol. 2024;31(2):49–57. https://doi.org/10.1026/2941-7597/a000008.
16. Michel-Kröhler A, Berti S. Experimental induction of state rumination in youth soccer players on the pitch: How can we evaluate an effect of rumination on soccer-specific performance? Eur J Sport Sci. 2025;25(9):e70021. https://doi.org/10.1002/ejsc.70021.
17. Michel-Kröhler A, Krys S, Berti S. The short form of the Sports Competition Rumination Scale (SCRS-SF) for applied sport psychology and research. J Appl Sport Exerc Psychol. 2025;32(2):58–63. https://doi.org/10.1026/2941-7597/a000043.
18. Ryff CD. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. J Personality Social Psychol. 1989;57(6):1069–81. https://doi.org/10.1037/0022-3514.57.6.1069.
19. Ryff CD, Keyes CLM. The structure of psychological well-being revisited. J Personality Social Psychol. 1995;69(4):719–27. https://doi.org/10.1037/0022-3514.69.4.719.
20. Ryff CD. Psychological well-being revisited: Advances in the science, and practice of eudaimonia. Psychother Psychosom. 2014;83(1):10–28. https://doi.org/10.1159/000353263.
21. Ryan RM, Deci EL. Self-determination theory, and the facilitation of intrinsic motivation, social development and well-being. Am Psychol. 2000;55(1):68–78. https://doi.org/10.1037/0003-066X.55.1.68.
22. Diener E, Wirtz D, Tov W, Kim-Prieto C, Choi D, Oishi S, Biswas-Diener R. New well-being measures: Short scales to assess flourishing and positive and negative feelings. Soc Indic Res. 2010;97(2):143–56. https://doi.org/10.1007/s11205-009-9493-y.
23. Telef BB. Psikolojik İyi Oluş Ölçeği: Türkçeye uyarlama, geçerlik ve güvenirlik çalışması. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi. 2013;28(3):374–84. https://dergipark.org.tr/tr/pub/hunefd/article/101929.
24. Tranaeus U, Gledhill A, Johnson U, Podlog L, Wadey R, Wiese Bjornstal D, Ivarsson A. 50 years of research on the psychology of sport injury: A consensus statement. Sports Med. 2024;54(7):1733–48. https://doi.org/10.1007/s40279-024-02045-w.
25. Akın G, Pehlivan A, Albayrak Kuruoğlu Y, Kesin M. The effect of 'Athlete Mindset Program (AMP)' on sports injury anxiety and athletic coping skills in U-16 football players. Turkish J Sports Med. 2024;59(4):158–63. https://doi.org/10.47447/tjsm.0843.

26. Bingöl H, Tiryaki M, Tümtürk İ, Özden AV. Investigation of exercise-related leg pain, fear of pain, kinesiophobia, and injury anxiety in athletes. BMC Sports Sci Med Rehabilitation. 2025;17:40. https://doi.org/10.1186/s13102-025-01079-5 .
27. Sayın-Temur C. The relationship between injury-related anxiety and participation motivation: Insights from athletes across competitive levels. Pakistan J Med Sci. 2025;41(6):1770–6. https://doi.org/10.12669/pjms.41.6.11798.
28. Biçer Baikoğlu S, Dal S, Avcı S, Güllü S, Özağır M, Şahinler Y, Zaman R, Akkoç O. The mediating role of rumination in the relationship between mindful awareness and athlete burnout. Healthcare. 2026;14(12):1795. https://doi.org/10.3390/healthcare14121795.
29. Pepe O, Turan MB, Dalbudak İ, Koçyiğit B, Bayıroğlu GB, Balyan M, Kır S. Breaking the cycle: How coping, and flexibility disrupt the link between kinesiophobia, and rumination in athletes. Behav Sci. 2025;15(9):1271. https://doi.org/10.3390/bs15091271.
30. Derelioğlu M, Vural M, Çimen E, Saki Ü, Yağız Saraçoğlu Y, Karataş B, Ceylan L. Exploring how cognitive-behavioral physical activity links ruminative thinking and mental wellbeing in sports high school adolescents. Front Psychol. 2025;16:1665882. https://doi.org/10.3389/fpsyg.2025.1665882.
31. Giummarra M, Lennox A, Dali G, Costa B, Gabbe B. Early psychological interventions for posttraumatic stress, depression and anxiety after traumatic injury: A systematic review and meta-analysis. Clin Psychol Rev. 2018;62:11–36. https://doi.org/10.1016/j.cpr.2018.05.001.
32. Meijen C, Turner M, Jones MV, Sheffield D, McCarthy P. A theory of challenge and threat states in athletes: A revised conceptualization. Front Psychol. 2020;11:126. https://doi.org/10.3389/fpsyg.2020.00126.
33. Moulds M, McEvoy P. Repetitive negative thinking as a transdiagnostic cognitive process. Nat Reviews Psychol. 2025;4(2):127–41. https://doi.org/10.1038/s44159-024-00399-6.
34. Capobianco L, Morris JA, Wells A. Worry and rumination: Do they prolong physiological and affective recovery from stress? Anxiety Stress Coping. 2018;31(3):291–303. https://doi.org/10.1080/10615806.2018.1438723.
35. Wang B. How menstrual sensitivity shapes well-being in female athletes: The mediating role of rumination and the buffering effect of resilient coping. Psychol Sport Exerc. 2026;87:103232. https://doi.org/10.1016/j.psychsport.2026.103232.
36. Kruger A, Jooste J, Kruger P. Work-related rumination as a mechanism linking neuroticism to mental health among South African professional rugby union players. Cogent Psychol. 2025;12(1):2592902. https://doi.org/10.1080/23311908.2025.2592902.
37. Blackie RA, Kocovski NL. Examining the relationships among self-compassion, social anxiety, and post-event processing. Psychol Rep. 2018;121(4):669–89. https://doi.org/10.1177/0033294117740138.
38. Brozovich FA, Heimberg RG. The relationship of post-event processing to self-evaluation of performance in social anxiety. Behav Ther. 2011;42(2):224–35. https://doi.org/10.1016/j.beth.2010.08.005.
39. Flynn AJ, Yoon KL. Post-event processing in social anxiety: A scoping review. J Anxiety Disord. 2025;109:102947. https://doi.org/10.1016/j.janxdis.2024.102947.
40. Gaydukevych D, Kocovski NL. Effect of self-focused attention on post-event processing in social anxiety. Behav Res Ther. 2012;50(1):47–55. https://doi.org/10.1016/j.brat.2011.10.010.
41. Kane L, Ashbaugh AR. Ecological momentary assessment of post-event processing in between two speech tasks: Relationships with cognitive and affective factors involved in the maintenance of social anxiety. Behav Res Ther. 2022;157:104208. https://doi.org/10.1016/j.brat.2022.104208.
42. Rowa K, Gavric D, Stead V, LeMoult J, McCabe RE. The pernicious effects of post-event processing in social anxiety disorder. J Experimental Psychopathol. 2016;7(4):577–87. https://doi.org/10.5127/jep.056916.
43. Wong QJJ, Rapee RM. The aetiology, and maintenance of social anxiety disorder: A synthesis of complementary theoretical models and formulation of a new integrated model. J Affect Disord. 2016;203:84–100. https://doi.org/10.1016/j.jad.2016.05.069.
44. Fetters MD, Curry LA, Creswell JW. Achieving integration in mixed methods designs: Principles, and practices. Health Serv Res. 2013;48(6 Pt 2):2134–56. https://doi.org/10.1111/1475-6773.12117.
45. Creswell JW, Plano Clark VL. Designing, and conducting mixed methods research. 3rd ed. SAGE; 2018.
46. Wolf EJ, Harrington KM, Clark SL, Miller MW. Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. Educ Psychol Meas. 2013;73(6):913–34. https://doi.org/10.1177/0013164413495237.
47. Karafil AY, Pehlivan E. Spor Müsabakası Ruminasyon Ölçeği'nin Türkçeye uyarlanması: Geçerlik ve güvenirlik çalışması. Gazi Beden Eğitimi ve Spor Bilimleri Dergisi. 2023;28(1):8–15. https://doi.org/10.53434/gbesbd.1158522.
48. Caz Ç, Kayhan RF, Bardakçı S. Adaptation of the sport injury anxiety scale to Turkish: Validity and reliability study. Turkish J Sports Med. 2019;54(1):52–63. https://doi.org/10.5152/tjsm.2019.116.
49. Braun V, Clarke V. Using thematic analysis in psychology. Qualitative Res Psychol. 2006;3(2):77–101. https://doi.org/10.1191/1478088706qp063oa.
50. Braun V, Clarke V. To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. Qualitative Res Sport Exerc Health. 2021;13(2):201–16. https://doi.org/10.1080/2159676X.2019.1704846.

51. Nowell LS, Norris JM, White DE, Moules NJ. Thematic analysis: Striving to meet the trustworthiness criteria. Int J Qualitative Methods. 2017;16:1–13. https://doi.org/10.1177/1609406917733847.
52. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007;19(6):349–57. https://doi.org/10.1093/intqhc/mzm042.
53. Hsu C-J, Meierbachtol A, George SZ, Chmielewski TL. Fear of reinjury in athletes: Implications for rehabilitation. Sports Health. 2017;9(2):162–7. https://doi.org/10.1177/1941738116666813.
54. Nolen-Hoeksema S. Responses to depression, and their effects on the duration of depressive episodes. J Abnorm Psychol. 1991;100(4):569–82. https://doi.org/10.1037/0021-843X.100.4.569.
55. Lu FJH, Hsu Y. Injured athletes' rehabilitation beliefs, and subjective well-being: The contribution of hope, and social support. J Athl Train. 2013;48(1):92–8. https://doi.org/10.4085/1062-6050-48.1.03.
56. Rees T, Hardy L. An investigation of the social support experiences of high-level sports performers. Sport Psychol. 2000;14(4):327–47. https://doi.org/10.1123/tsp.14.4.327.
57. Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables, and measurement error. J Mark Res. 1981;18(1):39–50. https://doi.org/10.1177/002224378101800104.
58. Hu L-T, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Struct Equ Model. 1999;6(1):1–55. https://doi.org/10.1080/10705519909540118.
59. Chen D-T, Lee K-H, Wong YM, Chan CT. Relationship between ruminative dispositions and perceived sports performance in young elite athletes in Hong Kong: The role of problem-oriented coping strategies. Front Sports Act Living. 2025;7:144219. https://doi.org/10.3389/fspor.2025.144219.
60. Erdem O, Cakmak Yildizhan Y. Investigation of the relationship between athletes' basic psychological needs, and sports success motivations. J ROL Sport Sci. 2024;5(4):733–49. https://doi.org/10.70736/jrolss.475.
61. Wang W, Schweickle MJ, Arnold ER, Vella SA. Psychological interventions to improve elite athlete mental wellbeing: A systematic review and meta-analysis. Sports Med. 2025;55(4):877–97. https://doi.org/10.1007/s40279-024-02173-3.
62. Singh A, Arora M, Boruah B. The role of the six factors model of athletic mental energy in mediating athletes' well-being in competitive sports. Sci Rep. 2024;14:2974. https://doi.org/10.1038/s41598-024-53065-5.

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