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Perfectionism and performance-related psychobiosocial states: The mediating role of competition appraisals

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ABSTRACT

Using the multi-states (MuSt) theory as a framework, the present study focused on the individual (personality) antecedents of psychobiosocial states. Psychobiosocial states comprise emotional subjective experiences and their correlates (cognitive, motivational, volitional, bodily, motor-behavioural, operational, and communicative), that can be functional for performance (helpful) or dysfunctional (harmful). Specifically, we examined the relationships between two perfectionism dimensions (perfectionistic strivings and concerns) and functional and dysfunctional psychobiosocial states. The hypothesized mediational role of competitive appraisals was also tested. Participants ($N = 271$, 138 female, 133 male, M age $= 22.74 \pm 7.01$) completed questionnaires assessing the targeted variables. Structural equation modelling revealed that perfectionistic strivings were positive predictors of functional states directly and via challenge appraisals. On the other hand, perfectionistic concerns were positive predictors of dysfunctional states directly and via threat appraisals. Results provide support to MuSt theory and extend the literature on the antecedents of athletes' performance-related feeling states. Findings also provide support for the holistic conceptualization of psychobiosocial states encompassing the functionality dimension. The results highlight the importance of developing interventions aimed at helping athletes high in perfectionistic concerns evaluate situations as a challenge (and less of a threat) and increasing their perceived resources.

HIGHLIGHTS

- Perfectionistic strivings positively related to functional psychobiosocial states
- Perfectionistic concerns positively related to dysfunctional psychobiosocial states
- Competitive challenge appraisals mediated the relationship between perfectionistic strivings and functional psychobiosocial states
- Competitive threat appraisals mediated the relationship between perfectionistic concerns and dysfunctional psychobiosocial states

KEYWORDS
Challenge appraisals; threat appraisals; MuSt theory; psychobiosocial states scale; structural equation modelling

Introduction

Athletes involved in competitive sport can experience a variety of emotional states that have been long recognized to have a pervasive influence on performance (Hanin, 2007). Research has advanced our understanding of the emotion-performance relationship and athletes' regulatory efforts (Beatty & Janelle, 2020; Friesen et al., 2013). A better understanding of the nature of emotion-related experiences and their antecedents is fundamental for the development of effective emotion regulation strategies. In this study, we examined personality antecedents of athletes' subjective experiences related to their performances.

One theoretical framework that considers the nature of performance-related states with implications for performance enhancement/optimization and athlete well-being is multi-states (MuSt) theory (Ruiz et al., 2021). MuSt theory was developed to understand individual performance experiences, predict performance, and identify effective self-regulation strategies. Drawing from the individual zones of optimal functioning (IZOF) model (Hanin, 2007; Ruiz et al., 2017), a main concept within MuSt theory is the construct of psychobiosocial

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states. Psychobiosocial states are regarded as subjective experiences or feelings and are conceptualized considering the interaction between the hedonic dimension (pleasant and unpleasant experiences) and the functionality dimension (functional and dysfunctional effects on performance). Psychobiosocial states are determined by athletes' appraisals of their interaction with the environment, their perceived resources, and their ability to cope with the demands of the situation. Several modalities related to psychological, biological, and social aspects collectively form psychobiosocial states.

The emotional experience is the primary component of the psychological part of psychobiosocial states and refers to the pleasant or unpleasant subjective experience or feeling. The cognitive modality involves aspects related to attention processing. The motivational modality refers to pre-decisional intentions and processes related to the deliberation on rewards and expectancies for choosing goals, while the volitional modality refers to post-decisional processes involved in initiating and maintaining an action until the goal is reached. Biological components of psychobiosocial states include bodily (e.g. tense muscles) correlates of emotions as well as motor-behavioural aspects related to the perception of movement characteristics and motor coordination. The social aspects of psychobiosocial states encompass the operational modality, which concerns perceptions about task-execution patterns and effectiveness, and the communicative modality, which relates to verbal and non-verbal communication between individuals influencing task execution (Ruiz et al., 2016).

Altogether, psychobiosocial states involve the experiences individuals have in relation to the whole range of performances, from most successful to least unsuccessful. Functional psychobiosocial states, typified by pleasant or unpleasant emotions, can help athletes mobilize their resources. On the other hand, dysfunctional states, also characterized by pleasant or unpleasant emotions, typically result from a perceived lack of resources or inability to cope.

MuSt theory focuses on the dynamic interactions among the individual, the task, and the environment and considers individual appraisals as important features in the emergence of athletes' feeling states. In the current study, we examined perfectionism as an individual difference (personality) variable antecedent of psychobiosocial states and the processes underlying this relationship (see Figure 1). One such mechanism deals with trait-like tendencies to appraise stressful situations as a challenge or threat, which have been previously examined in sport settings (McLoughlin et al., 2022; Moore et al., 2019). Two main types of appraisals have been distinguished, those reflecting challenge and threat perspectives, depending on whether the athlete's cognitive response is beneficial or detrimental (Lazarus, 2000; Sammy et al., 2021). A challenge appraisal results from a positive evaluation of anticipated benefits reflecting sufficient perceived personal resources to meet situational or task demands, which involve self-efficacy, perceived control, and approach goals to manage task demands (Jones et al., 2009). In contrast, threat appraisals are triggered by a negative evaluation or anticipated harm which occurs when task demands are perceived as exceeding personal resources. This evaluation can derive from low self-efficacy levels, low perceived control, and/or avoidance goals.

Researchers have highlighted the importance of challenge and threat appraisals as motivational states that include cognitive and affective aspects and trigger distinct psychophysiological patterns (Blascovich, 2008; Jones et al., 2009). In particular, challenge appraisals are thought to determine low total peripheral resistance and high cardiac output via activation of the sympathetic-adrenomedullary axis, while threat appraisals are suggested to determine high total pressure resistance and low cardiac output through the activation of the sympathetic-adrenomedullary axis and the pituitary-adrenocortical axis (for a review, see Seery, 2011). Competitive appraisals have important implications for performance with challenge appraisals being associated with more pleasant affect, better attentional control, and superior performance than threat appraisals (Brimmell et al., 2019; Wood et al., 2018). For example, research has shown that baseball and softball athletes who appraised a hypothetical sports scenario as a challenge performed better during the subsequent season than athletes who appraised it as a threat (Blascovich et al., 2004). MuSt theory extends these notions and posits that challenge appraisals can trigger functional states and high-level performance characterized by either effortless or effortful action monitoring. Conversely, threat appraisals can result in dysfunctional states typified by either excessive reinvestment of attention on task execution or loss of focus and low task engagement.

Athletes' appraisals of their interaction with the environment and, consequently, their subjective experiences are known to be influenced by personality factors (Lazarus, 2000; Ruiz et al., 2021). For example, athletes' perceived ability to identify, express and regulate emotions, known as emotional intelligence, has been constantly found to predict challenge appraisals, while broad personality traits such as neuroticism are positively associated with threat appraisals (Kilby et al., 2018).

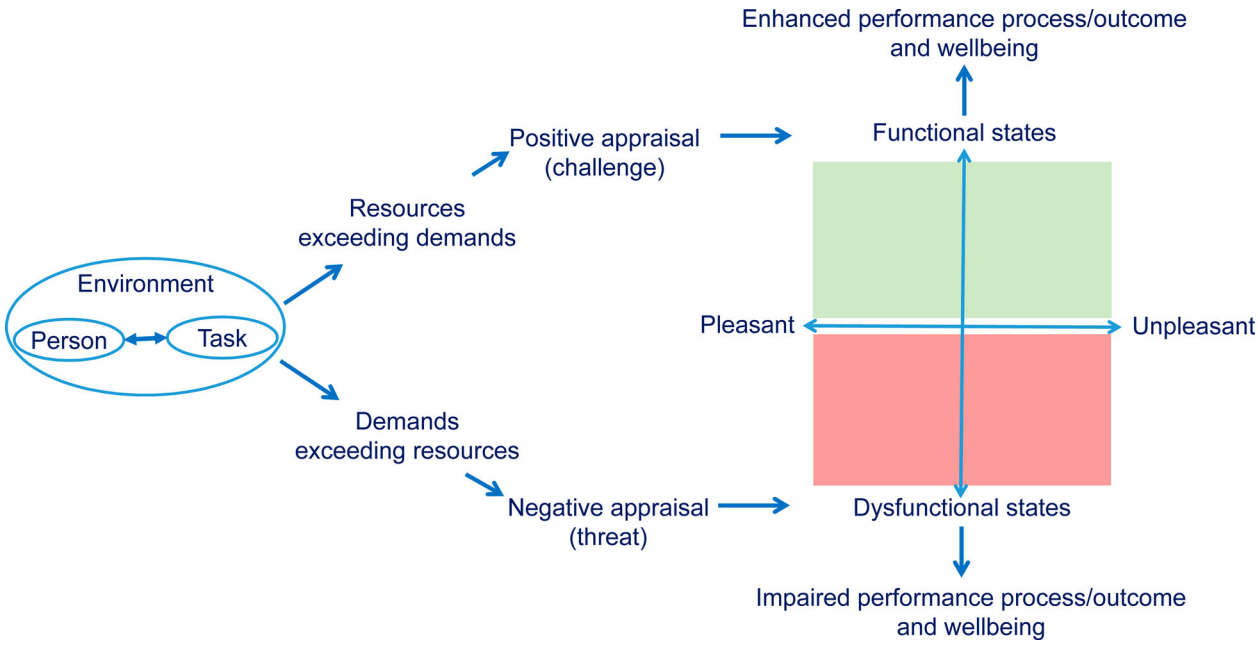

Figure 1. Overview of the hypothesized relationships among antecedents (task, environment, and person), mediators (cognitive appraisals), functional and dysfunctional psychobiosocial states, and consequences for performance and wellbeing drawn from multi-states (MuSt) theory.

Perfectionism is another personality characteristic, related to cognitive appraisals and emotional experiences of athletes, that has received increasing attention in sport (e.g. Donachie et al., 2018). A multidimensional conceptualization of perfectionism has been advocated in which perfectionistic strivings and perfectionistic concerns have been identified as two higher-order dimensions of the perfectionism trait (Gotwals et al., 2012; Stoeber, 2012). Perfectionistic strivings refer to the degree to which athletes set and strive for very high personal standards of performance. Conversely, perfectionistic concerns capture aspects of perfectionism related to athletes' concerns over making mistakes, fear of negative social evaluation, and consequences of failing to achieve high standards.

There is a large body of research on the outcomes associated with the two higher-order perfectionism dimensions in sport, suggesting they likely influence athletes' emotional responses. Indeed, there is empirical evidence indicating that perfectionistic concerns are associated with constructs reflecting psychological maladjustment such as fear of failure, worry, anxiety, negative affect, or rumination (for a meta-analysis, see Hill et al., 2018). Evidence on the correlates of perfectionistic strivings has been inconsistent, in contrast, suggesting that perfectionistic strivings are associated with both adaptive and maladaptive outcomes. Some research has indicated adaptive outcomes of heightened perfectionistic strivings when perfectionistic concerns have been controlled for or when high striving is accompanied by low concerns (Dunn et al., 2020). For instance, findings indicate that perfectionistic strivings were positively related to anxiety and worry, while negative relationships were observed when degree of perfectionistic concerns were taken into account (Hill et al., 2018).

In addition to influencing emotional responses, the two perfectionism dimensions are assumed to contribute to differential cognitive appraisals (see Zureck et al., 2015). Individuals with high perfectionistic concerns have a more pronounced tendency towards being self-critical and holding a sense of doubt regarding the quality of their performance. Consequently, it is not surprising that research on perfectionistic concerns outside of sport has confirmed a positive association with threat appraisals (Stoeber & Rennert, 2008; Zureck et al., 2015) and an inverse relationship with challenge appraisals (Stoeber & Rennert, 2008). The commitment to the achievement of elevated performance goals for those individuals demonstrating high perfectionistic strivings, in contrast, may increase the extent to which the situation is appraised as a challenge and less threatening (Zureck et al., 2015). This finding has been supported in research with teachers (Stoeber & Rennert, 2008).

In line with the MuSt theory (Ruiz et al., 2021) assumptions, personal characteristics such as perfectionism is a determinant of athletes' appraisals and psychobiosocial states. However, to date, the relationships between perfectionism dimensions, appraisals, and athletes' feeling

states have not been properly investigated. For instance, previous perfectionism studies have examined a selected number of emotions such as anxiety, anger, dejection (for a meta-analysis, see Hill et al., 2018). While these emotions are important indicators of well-being, athletes typically report a wider range of pleasant and unpleasant experiences associated with their performances (for a review, see Ruiz et al., 2017). Limiting an investigation to only a few emotions does not, therefore, allow for the examination of the broader spectrum of experiences that athletes can have. Crocker et al. (2014) found perfectionistic concerns to be associated with threat appraisals, fear of failure, and negative affect, while perfectionistic strivings were associated with challenge appraisals and positive affect. However, the conceptualization and measurement of affect used in such research is problematic and has been heavily criticized (Ekkekakis, 2013). For instance, the distinction of positive and negative affect is based on a two-dimensional solution derived from factor analysis of items reflecting valence and perceived activation. Items reflecting only high-activation states are taken into account while low-activation states were not considered in this work (Crocker et al., 2014). In competitive sport, considering valence (pleasant or unpleasant) as well as functionality (functional or dysfunctional impact on performance) of athletes' experiences is fundamental (Ruiz et al., 2017, 2021). Both dimensions are the basis for the conceptualization of athletes' feeling states used in this study. Finally, previous research concerning the interrelationships between perfectionism dimensions, cognitive appraisals, and affect have only considered single indicators of perfectionistic strivings and concerns (see Hill et al., 2018). As a result, these studies have not captured the broad nature of the two perfectionism dimensions.

Study purpose

The purposes of this study were to (1) examine the relationships between athletes' perfectionistic strivings (i.e. striving for perfection and personal standards), perfectionistic concerns (i.e. negative reactions to imperfection, concerns about mistakes, and doubts about actions), competition appraisals (i.e. challenge, threat), and psychobiosocial states as experienced in sport, and (2) test whether competition appraisals mediate the relationship between the perfectionisms dimensions and psychobiosocial states. Based on the tenets of MuSt theory (Ruiz et al., 2021) and previous perfectionism research (Hill et al., 2018; Stoeber, 2018), we hypothesized that athletes' perfectionistic strivings would be positively related to challenge appraisals and functional psychobiosocial states. In contrast, perfectionistic concerns were expected to be positively related to threat appraisals and dysfunctional psychobiosocial states. Perfectionistic strivings were expected to be negatively associated with threat appraisals, while perfectionistic concerns would be negatively related to challenge appraisals. Furthermore, challenge appraisals were hypothesized to be positively related to functional psychobiosocial states, while threat appraisals were predicted to be positively related to dysfunctional states. Finally, we expected competition appraisals to mediate the relationships between perfectionistic dimensions and athletes' psychobiosocial states.

Method

Participants

A priori sample size calculation for structural equation modelling (anticipated effect size .25, power .80, $p < .05$, 6 factors, 20 observed variables), suggested a minimum sample size of 246 (Soper, 2021). Participants were 271 British athletes (138 female, 133 male): 165 involved in team sports (e.g. football, hockey, American football) and 106 involved in individual sports (e.g. fencing, tennis, squash). Participants' mean age was 22.74 years ($SD = 7.01$). Ninety-seven participants were national (and above) and 171 regional level competitors. Three participants did not indicate their competitive level. The participants had practiced their sport for 10.29 years ($SD = 6.39$).

Measures

Perfectionism

The Multidimensional Inventory of Perfectionism in Sport (MIPS; Stoeber et al., 2008) assessed striving for perfection (5 items) and negative reactions to imperfection (5 items). Participants rated statements reflecting the extent to which they usually strive for perfection in relation to competing ("I strive to be as perfect as possible") or negative reactions to imperfection ("I get completely furious if I make mistakes") on a 6-point Likert scale (0 = *never*; 5 = *always*). Good psychometric properties were reported with Cronbach alphas ≥ .80 (Stoeber et al., 2008).

Three subscales from the Sport-Multidimensional Perfectionism Scale-2 (Sport-MPS-2; Gotwals & Dunn, 2009) were used to assess personal standards (7 items; "I hate being less than the best at things in my sport"), concerns over mistakes (8 items; "If I fail in competition, I feel like a failure as a person"), and doubts about actions (6 items; "Prior to competition, I rarely feel satisfied with my

training"). Responses were rated on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). Acceptable Cronbach alphas ≥ .76 were reported (Gotwals et al., 2010).

The perfectionistic strivings factor was measured on the MIPS striving for perfection subscale and the Sport-MPS-2 personal standard subscale. The perfectionistic concerns factor consisted of the MIPS negative reactions to imperfection subscale and Sport-MPS-2 concern over mistakes and doubts about actions subscales.

Competition appraisals

Cognitive appraisals of sport competition were assessed on the challenge and threat construal measure (Adie et al., 2008). The 10-item scale assesses participants' perceptions in a hypothetical scenario of an important upcoming competition in terms of challenge (5 items; e.g. "I view the competition as a positive challenge") and threat (5 items; e.g. "I think that the competition could be threatening to me"). Participants were asked to respond recalling on actual previous experiences by rating the degree to which they would typically appraise such competition as more or less challenging. Responses were rated on a 7-point Likert scale (1 = *not at all true to me;* 7 = *very true to me*). Acceptable Cronbach alpha values > .73 and predictive validity were reported (Adie et al., 2008).

Performance-related feeling states

Participants' feeling states were measured on the Psychobiosocial States Scale (PBS-S scale; Ruiz et al., 2019), which is based on the individualized profiling of psychobiosocial states (Ruiz et al., 2016). The PBS-S includes a total of 20 rows of items and 74 descriptors. Each row of items contains 3–4 descriptors. For the affective modality, three items assess functional states and other three items assess dysfunctional states (i.e. pleasant states, anxiety, and anger). Examples of items capturing functional and dysfunctional anger are "fighting spirit, fierce, aggressive" and "furious, resentful, irritated, annoyed". For the other seven modalities (i.e. cognitive, motivational, volitional, bodily, motor-behavioural, operational, and communicative), two rows of items measure functional and dysfunctional aspects. For example, cognitive aspects are measured on the following items: "alert, focused, attentive" (cognitive functional), and "distracted, overloaded, doubtful, confused" (cognitive dysfunctional), while motor-behavioural aspects are assessed on "relaxed-, coordinated-, powerful-, effortless-movement" (functional motor-behavioural) and "sluggish, clumsy, uncoordinated, powerless-movement" (dysfunctional motor-behavioural). Participants are asked to respond how they feel in relation to their next upcoming competition. They assess the intensity for each item using the following verbal anchors: 0 = *nothing at all*, 0.5 = *very, very little*, 1 = *very little*, 2 = *little*, 3 = *moderately*, 5 = *much*, 7 = *very much*, 10 = *very, very much*, • = *maximal possible* (11 score is attributed to *maximal possible*). Scores are computed to form two factors (functional and dysfunctional states). Support for a two-factor solution was provided with Finnish athletes (Ruiz et al., 2019) with comparative fit index (CFI) = .932, Tucker – Lewis index (TLI) = .915, root-mean-square error of approximation (RMSEA) = .051, and standardized root mean square residual (SRMR) = .054.

Procedure

The participants were recruited from university sport teams, sport federations, and clubs in England. The study purpose was explained to team coaches and managers to gain access to the participants. Data collection commenced following ethical approval from the local institution review board.[1] Participants were informed of the study purpose. Confidentiality of individual results and voluntary nature of participation were emphasized. Measures were administered prior to a practice session using a paper-and-pencil format. Assessments were completed in a quiet place, close to participants training facilities, and took approximately 30 minutes.

Statistical analyses

Data were screened for missing values, distribution, and outliers (Hair et al., 2019). Missing data (missing at random) ranged from 0% to 3.3% (in the case of dysfunctional motivational item) and were thus below the recommended 5%. Two cases, identified as multivariate outliers based on Mahalanobis' distance criterion larger than the critical value of $\chi^2(6) = 22.46$, $p < .001$ were deleted, resulting in a final sample of 269 participants. The factorial structure of the measures was ascertained via confirmatory factor analyses (CFA) with Mplus 8.5 (Muthén & Muthén, 2017). Normal probability plots and Kolmogorov–Smirnov tests indicated that data deviated from normal distribution. Therefore, Mplus missing-data function was used together with maximum likelihood estimator (MLR) to adjust for non-normality with the robust full information. Model fit was evaluated by examining several fit indices (i.e. CFI, TLI, RMSEA, and SRMR). CFI and TLI values close to .95, RMSEA values between .05 and .08, and SRMR values smaller than .05 are indicative of acceptable model fit (Schumacker & Lomax, 2016).

Descriptive statistics, bivariate correlations, reliability including Cronbach's alpha (α), McDonald's omega (ω), and composite reliability (CR) values were calculated for all variables. The following criterion was used to interpret correlations: 0–0.19 = no correlation, 0.20–0.39 = low correlation, 0.40–0.59 = moderate correlation, 0.60–0.79 = moderately high correlation, and ≥0.8 = high correlation (Zhu, 2012). Adequate reliability was established for α and ω values greater than .70. Average variance extracted (AVE) was computed, with values close to or larger than .50 indicative of adequate item convergence (Hair et al., 2019). Mean scores differences in the study variables across gender (male, female), sport type (team, individual), and competitive level (regional vs. national) were calculated through multivariate analysis of variance (MANOVA).

Possible mediator effects of competitive appraisals were tested using structural equation modelling. Since bootstrapping is unavailable with MLR, indirect effects were tested using maximum likelihood estimator (ML) and bias-corrected bootstrap method based on 5000 resamples. Indirect effects are significant when zero is not included in the upper and lower 95% confidence intervals (CI; MacKinnon, 2008).

Results

Psychometric properties of the measures

CFAs with individual items for perfectionistic dimensions and psychobiosocial states fit the data poorly.[2] Therefore, item parcelling was used with items combined into construct-specific parcels by summing the scores based on the theoretical structure of the measures as new indicators of the underlying latent factors. Considering the study purpose was to examine the relationships among the variables rather than the examination of measurement properties alone, we deemed this strategy more appropriate than correlating residual/errors, which may lead to increase in sampling errors (Little et al., 2002). Advantages of this strategy involve parcels being more likely to be strongly related to the latent factor and to conform to multivariable normality assumptions, resulting in a more parsimonious model, more optimal ratio of variable to sample size, and more stable parameter estimates (Wang & Wang, 2020).

In the case of perfectionism, four parcels, with three items each, were formed from the MIPS striving for perfection subscale and the Sport-MPS-2 personal standards subscale. These parcels were used as indicators of the perfectionistic strivings factor. Each parcel included one or two items from each subscale. Four parcels, with four to five items each, were formed based on the sums of items from the MIPS negative reactions to imperfection subscale, and the Sport-MPS-2 concerns over mistakes subscale and doubts about actions subscales. These parcels formed the indicators of the perfectionistic concerns factor. Each parcel forming the perfectionistic concerns factor included one or two items from the MIPS subscale and three to four items from the Sport-MPS-2 subscale. A two-factor solution with parcels including the 31 items fit data well (see Table 1).

Regarding psychobiosocial states, the theoretical structure including psychological, biological, and social aspects of the states, was used in the makeup of the parcels. Three parcels were calculated as indicators of the functional states factor. Specifically, one parcel included the sums of cognitive and affective (i.e. pleasant, anxiety, and anger) items, a second parcel included sums of motivational, volitional, and bodily items, and a third parcel included sums of operational, communicative, and motor-behavioural items. Three parcels were calculated with the sums of the remaining dysfunctional items as indicators of the dysfunctional states factor, following the same strategy. That is, one parcel included cognitive, anxiety, and anger items; a second parcel included motivational, volitional, and bodily items; and a third parcel included operational, communicative, and motor-behavioural items. CFAs did not yield satisfactory fit indices and further examination suggested removal of two items (i.e. harmful pleasant and helpful anxiety). The two-factor solution with six parcels including 18 items yielded good fit to the data (Table 1).

In the case of competitive appraisals and due to the small number of items (five per subscale) individual items were used. An examination of factor loadings

Table 1. Fit indices for the study variables derived from confirmatory factor analyses.

Measures	χ^2(df)	CFI	TLI	RMSEA (90% CI)	SRMR
Perfectionism (31 items, 8 parcels)	23.263 (19)	.997	.996	.029 (.000–.064)	.021
Competition appraisals (10 items, 2 factors)	159.872 (34)	.806	.743	.117 (.099–.136)	.099
Competition appraisals (6 items, 2 factors)	19.886 (8)	.960	.924	.074 (.034–.116)	.043
Psychobiosocial states (20 items, 6 parcels)	83.037 (8)	.875	.766	.187 (.152–.225)	.100
Psychobiosocial states (18 items, 6 parcels)	19.925 (8)	.981	.964	.075 (.034–.116)	.037

Note: χ^2(df) = chi-square (degrees of freedom); CFI = comparative fit index; TLI = Tucker – Lewis fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

and modification indices suggested removal of four items (i.e. "I often think about what it would be like if I did badly in this competition", "I view the competition as a threat", "I often think about what it would be like if I did well in the competition", and "I believe the competition could have positive consequences for me"). Fit for a 6-item two-factor (challenge appraisal, threat appraisal) solution was acceptable. Standardized factor loadings for all measures were >.40. CFA results are reported in Table 1.

Reliability indices, composite reliability, and variance extracted values were acceptable (see Table 2). MANOVA yielded significant results by sport type, Pillai's trace = 0.051, $F(6, 251) = 2.238$, $p = .040$, $\eta_p^2 = .051$, and competitive level, Pillai's trace = 0.067, $F(6, 251) = 3.009$, $p = .007$, $\eta_p^2 = .067$. Univariate follow-up showed that team sport athletes reported significantly higher mean scores on perfectionistic concerns and functional states. Higher-level competition athletes reported significantly higher mean scores on perfectionistic concerns than lower-level competitors. No significant results were observed across gender or in regard to respective interactions ($p \geq .424$).

Structural equation modelling and indirect effects

The hypothesized model, controlling for competitive level and sport type, showed acceptable fit, χ^2 (198) = 316.971, CFI = .957, TLI = .950, RMSEA = .048 (90% CI = .038–.057), SRMR = .076. Examination of modification indices suggested including two additional relationships, one path from perfectionistic strivings to dysfunctional states, and a path from perfectionistic concerns to challenge appraisals. These modifications were consistent with theoretical assumptions predicting a negative relationship between perfectionistic strivings and concerns with dysfunctional states and challenge appraisals, respectively. The modified model fit the data well, χ^2 (196) = 271.185, CFI = .973, TLI = .968, RMSEA = .038 (90% CI = .026–.048), SRMR = .049 (see Figure 2). As expected, perfectionistic strivings positively associated with challenge appraisals and functional psychobiosocial states, and negatively associated with dysfunctional states. Perfectionistic concerns positively associated with threat appraisals and dysfunctional states, and negatively associated with challenge appraisals. Challenge appraisals were positively associated with functional states, while threat appraisals were positively associated with dysfunctional states.

Results from indirect analyses indicated a significant positive indirect effect of perfectionistic strivings on functional states, via challenge appraisals ($\beta = .152$; SE = .048; 95% CI = .076 to .269). A significant positive indirect effect emerged from perfectionistic concerns and dysfunctional states, via threat appraisals ($\beta = .060$; SE = .031; 95% CI = .008 to .131). As depicted in Figure 2, the direct paths from perfectionistic strivings to functional states ($\beta = .257$; SE = .074; 95% CI = .112 to .398) and from perfectionistic concerns to dysfunctional states ($\beta = .603$; SE = .112; 95% CI = .379 to .820) were also significant.

Discussion

Based on the tenets of MuSt theory (Ruiz et al., 2021) and conceptualizations of perfectionism and related research, this study investigated the inter-relationships between two perfectionism dimensions, challenge and threat appraisals, and the psychobiosocial states of athletes. On the whole, athletes reported a moderately high tendency to strive for perfection, positive evaluations regarding an upcoming competition, and moderate intensities of functional psychobiosocial states (Table 2). Lower scores were reported for perfectionistic concerns, threat appraisals, and dysfunctional states. Thus a functional and adaptive pattern emerged overall. A moderately high correlation was found between perfectionistic strivings and perfectionistic concerns. Although there was shared variance between the two perfectionism dimensions, our results provide a clear and differential pattern in terms of the relationships between

Table 2. Descriptive statistics, Pearson product-moment correlation coefficients, and reliability indices for the latent variables (N = 269).

Variable	Mean	SD	1	2	3	4	5	α	ω	CR	AVE
1. Perfectionistic strivings	3.20	.79						.882	.880	.920	.973
2. Perfectionistic concerns	2.52	.72	.626†					.900	.903	.916	.972
3. Challenge appraisals	5.57	.98	.117**	−.149**				.785	.787	.787	.880
4. Threat appraisals	2.87	1.24	.169	.288*	−.475§*			.743	.746	.745	.862
5. Functional states	5.99	1.53	.247*	.027**	.305*	−.106**		.852	.853	.846	.943
6. Dysfunctional states	2.96	1.83	−.008**	.319*	−.207**	.239*	−.059	.888	.888	.892	.972

Note. α = Cronbach's alpha values, ω = McDonald's omega, CR = composite reliability, AVE = average variance extracted; *low correlation, §moderate correlation, †moderately high correlation.

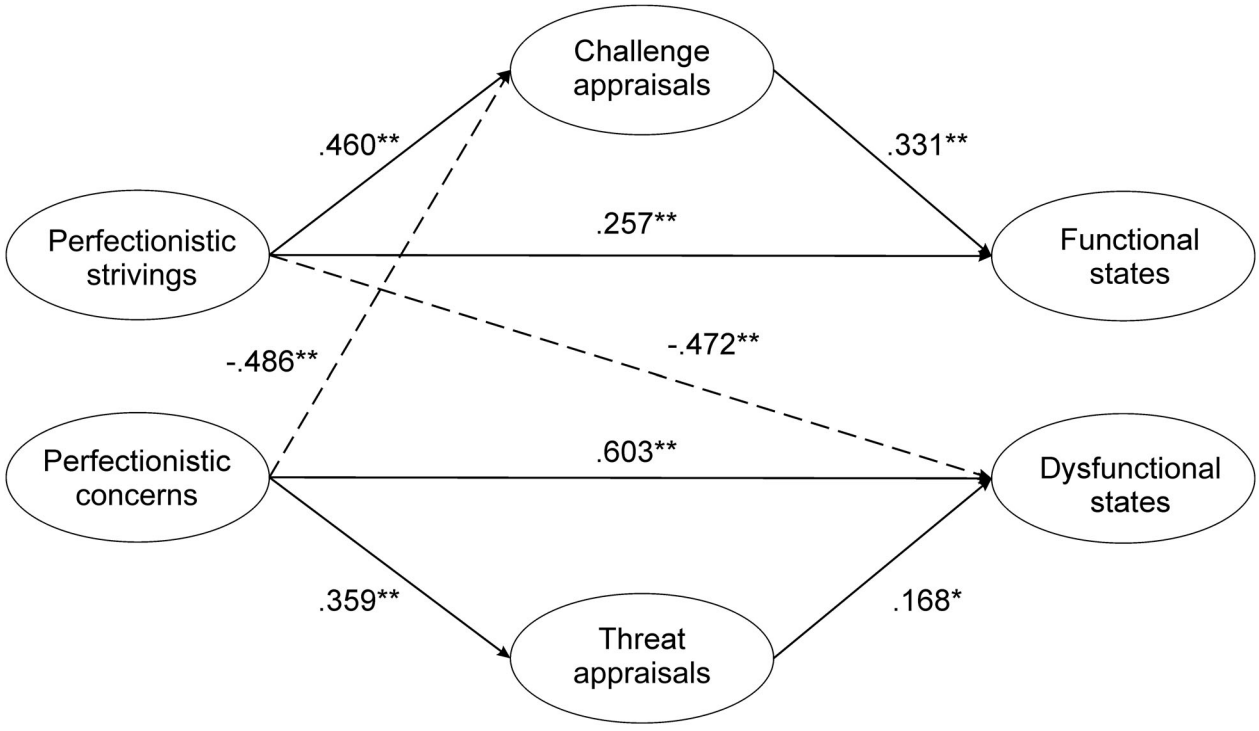

Figure 2. Structural equation model illustrating interrelationships among perfectionism dimensions, competitive appraisals, and psychobiosocial states. *$p < .05$, **$p < .001$. $N = 269$. Standardized beta coefficients are presented. Solid lines represent significant positive paths and dash lines represent significant negative paths.

perfectionistic strivings and perfectionistic concerns in regard to the other targeted study variables.

Athletes involved in higher-level competitions (national and above) reported significantly higher scores in perfectionistic concerns than lower-level competitive athletes. This finding may be explained by the heightened pressure to perform and more salient consequences of poor performance for higher-level athletes. Significant differences were also observed in perfectionistic concerns by sport type, with athletes involved in team sports reporting higher scores than their counterparts involved in individual sports. This finding, consistent with previous research (Gucciardi et al., 2012), may be explained by the shared responsibility to perform and interdependence of athletes involved in team sports. Interestingly, significantly higher scores in functional psychobiosocial states were also reported by athletes involved in team sports as compared to those involved in individual sports. This finding is in line with previous research that shows male team sport participants reporting higher scores for functional states compared to athletes in individual sports (Morano et al., 2020). This difference may indicate that athletes involved in team sports share experiences that arise from common interactions between team members. This finding also highlights the importance of a multimodal assessment of athletes' feelings states capturing different aspects of their experiences associated with performance.

This study extends the current literature on personality antecedents of athletes' feeling states in two ways. First, the relationship between perfectionism dimensions and competitive appraisals is underscored, suggesting that perfectionistic characteristics are relevant to athletes' evaluations of their resources and ways of coping. Perfectionistic concerns displayed a medium positive relationship with threat appraisals and a medium-to-large negative association with challenge appraisals. The former finding is in line with previous research reflecting the potential maladaptive effects of this dimension of perfectionism (Hill et al., 2018) and research outside of sport that has confirmed a positive relationship between facets of perfectionistic concerns and threat appraisals in non-athletes (Stoeber & Rennert, 2008; Zureck et al., 2015). The medium-to-large negative relationship between perfectionistic concerns and challenge appraisals concurs with theoretical conceptualizations of challenge and threat appraisals (Jones, et al., 2009) by which lack of concerns over making mistakes is expected to associate with more positive appraisals of the situation and perceived resources, or perceptions of being in control or able to cope with a situation. Regarding perfectionistic strivings, previous

research yielded inconsistent evidence, suggesting both adaptive and maladaptive consequences (Hill et al., 2018). Our findings indicate clear adaptive features of perfectionistic strivings, with a medium-to-large positive relationship with challenge appraisals, while no significant relationship with threat appraisals was observed. Although this latter finding is inconsistent with research outside of sport that revealed a significant negative correlation between perfectionistic strivings and threat appraisal in teachers (Stoeber & Rennert, 2008), our study does provide further evidence that achievement-related activities within sport are more likely to be appraised as a challenge (rather than a threat) when the individual strives towards standards that are personally relevant and focused on the attainment of high level performance.

Second, the findings suggest that both perfectionistic dimensions and appraisals have important implications for athletes' feeling states. A large positive relationship emerged between perfectionistic concerns and dysfunctional states providing further evidence of the detrimental consequences of athletes' negative reactions to imperfection, concerns over making mistakes, and doubts about their actions. The maladaptive patterns of perfectionistic concerns are well-substantiated in the literature which has reported positive links with unpleasant emotions (e.g. anxiety, anger, worry), and burnout (Dunn et al., 2020; Grugan et al., 2020). The findings in the current study also showed that perfectionistic strivings displayed a small-to-medium positive relationship with functional states, and a medium-to-large negative relationship with dysfunctional states. These results add to the growing body of literature that has identified positive correlates of this dimension of perfectionism.

Importantly, our findings also revealed one mechanism that may explain the reported relationships between the targeted perfectionism dimensions and outcomes: namely, cognitive appraisals. That is, cognitively appraising the sporting situation as a challenge (and less of a threat) may enable athletes high in perfectionistic striving to experience more functional feeling states, whereas appraising the situation as a threat (and less of a challenge) may lead athletes high in perfectionistic concerns to experience dysfunctional feeling states. The present findings also concur with theoretical assumptions on the appraisal-emotion relationship (Blascovich, 2008; Jones et al., 2009; Sammy et al., 2021), supporting the notion that competition appraisals involve cognitive and affective aspects reflecting differences in individuals' evaluations of the situation. Challenge appraisals reflect the perceived availability of resources and ability to cope with the task demands of athletes high in perfectionistic strivings, whereas threat appraisals reflect the lack of resources or perceived inability to cope of athletes high in perfectionistic concerns.

Strengths, limitations, and future research directions

This study has some strengths and limitations. First, we combined subscales from two measures to assess two dimensions of perfectionism. Thus, we examined more than one facet of each perfectionism dimension to overcome limitations of using individual scales as single indicators and better capture the nature of the two broad perfectionism dimensions (Stoeber & Madigan, 2016). Second, the construct of psychobiosocial states used in this study reflected a broad range of athletes' experiences related to their performances which include, but are not limited to emotions.

One of the limitations is related to the cross-sectional nature of the study, which does not allow us to provide evidence on causality. Future research adopting longitudinal designs are warranted to further understand the temporal ordering of the relationships studied, while experimental studies would allow researchers to use actual competition to examine the effects of perfectionism on psychobiosocial states, as well as, the role played by challenge and threat appraisals.

Additional research is also needed to examine if the relationships between dispositional characteristics (i.e. perfectionism dimensions and appraisals) with feeling states related to an upcoming performance would be different as a function of level of measurement, for example, focusing on appraisals of an actual upcoming competition versus dispositional appraisals. Future research could also include different measures of appraisals, such as the challenge and threat in sport scale (Rossato et al., 2018) or the appraisal of challenge and threat scale (Tomaka et al., 2018) which considers individual differences in the tendency to appraise the situations as well as reactions. The impact of perfectionism on competitive appraisals and athletes' feeling states could also be investigated using objective physiological markers (e.g. of cardiovascular reactivity) in pressurized situations.

The interaction between psychobiosocial states and attentional processes has been advocated within MuSt theory (Ruiz et al., 2021). A particular state depends on the type of feeling states experienced, as well as on the athlete's differential levels (i.e. high/low) of action monitoring or voluntary control. For example, pleasant-functional states and low levels of action monitoring usually underpin flow-like states, while unpleasant-

dysfunctional states and higher levels of voluntary action control are common in choking under pressure circumstances. Future research should examine the differential relationship between the perfectionism dimensions, challenge and threat appraisals, functional and dysfunctional states, and attentional processes, which would shed more light on the emergence of the variety of states athletes experience in relation to their performances.

Finally, to further test the assumptions of MuSt theory (Ruiz et al., 2021) and advance our understanding of the self-regulation process, future research should examine the role of other antecedent personality variables or traits (e.g. emotional intelligence, optimism, conscientiousness), situational factors (e.g. several competitions within a season, motivational climate), and task characteristics (e.g. individual vs. team sports, judged vs. objective performance), as well as investigate the consequences of psychobiosocial states on the performance process, competitive outcomes and wellbeing of athletes.

Conclusions and implication for practice

Study results indicate that perfectionistic strivings directly and positively associate with functional states, as well as indirectly through the mediation of challenge appraisals. Perfectionistic concerns directly and positively linked to dysfunctional states, as well as indirectly via threat appraisals. From an applied perspective, coaches can help athletes deal with their negative reactions to imperfection, diminish their concerns about mistakes, appraise errors as part of their learning and performance process (for a review, see Hase et al., 2019) and, therefore, attain functional states for optimal performance. Practitioners could also develop and deliver cognitive–behavioural interventions to enable athletes to identify and modify their perfectionistic or irrational thoughts, re-appraise the demands of the situation, and focus on their available coping resources (e.g. Donachie & Hill, 2020).

Overall, the present research extends the literature on the antecedents of athletes' performance-related states. Future research should include psychophysiological markers associated with these variables and the effects on actual performance and wellbeing.

Notes

1. Data were collected prior to the COVID-19 pandemic was declared.
2. CFA model fit for the 31-item two-factor perfectionistic dimensions (perfectionistic strivings, perfectionistic concerns) was χ^2 (433) = 1587.598, CFI = .682, TLI = .659, RMSEA = .100 (90% CI = .094–.105), SRMR = .118. CFA model fit for 20-item two-factor (functional states, dysfunctional states) psychobiosocial states solution was χ^2 (134) = 264.117, CFI = .906, TLI = .892, RMSEA = .060 (90% CI = .049–.071), SRMR = .064.

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