

## Stress mindset in athletes: Investigating the relationships between beliefs, challenge and threat with psychological wellbeing

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### ABSTRACT

**Objective:** Stress is omnipresent in daily life and can be acutely experienced by athletes due to additional circumstances such as deselection and injury. Trait beliefs athletes have about the stress they experience as well as the cognitive appraisals of this stress may be important in determining psychological wellbeing. The present study aimed to investigate the relationships between stress mindset, irrational beliefs, cognitive appraisals and psychological wellbeing in athletes using path analysis. Broadly speaking, it was hypothesised that stress mindset would relate negatively to depressive symptoms and positively to vitality through appraisals (i.e., challenge and threat), while irrational beliefs would relate to positively to depressive symptoms and negatively to vitality through appraisals.

**Methods:** 415 athletes (227 females, Mage = 33.86 years, SD = 17.73) completed an online questionnaire pack assessing stress mindset, irrational beliefs, challenge and threat appraisals, depressive symptoms, and vitality. Using path analysis, the tested hypothesised model demonstrated an excellent fit to the data.

**Results:** Findings demonstrate that the relationships between stress mindset, irrational beliefs and psychological wellbeing is linked by direct and indirect effects of challenge and threat in athletes. Stress mindset was positively associated with challenge and negatively associated with threat, whilst self-depreciation and awfulizing demonstrated significant positive associations with threat. Self-depreciation was found to significantly relate to stress mindset, challenge, threat and depressive symptoms to a greater extent than the other types of irrational beliefs.

**Conclusions:** Findings suggest practitioners should be aware of the role that stress mindset and other irrational beliefs have in potentially influencing athlete psychological wellbeing.

Stress has been defined as “the relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being” (Lazarus & Folkman, 1984, p. 21). Stressors are also commonplace for athletes due to a variety of factors such as injury, deselection and competitive failures (Turner et al., 2019b). Athletes experiencing greater or more long-term stress may display depressive symptoms which can result in a clinical diagnosis of depression (Rice et al., 2016). This process is said to occur as chronic stress can cause long-term changes in an individual’s emotions, physiology and behaviours which can influence susceptibility to depressive symptoms (Cohen et al., 2007), such as low mood, persistent fatigue, disturbed sleep and low self-esteem (WHO, 2019). Additionally, subjective vitality (i.e., feeling alive and full of energy; Ryan & Frederick, 1997) can be depleted due to chronic stress (Rozanski & Kubzansky, 2005). Vitality has been highlighted by some studies as a predictor of psychological wellbeing (Lavrusheva, 2020) and has been

noted for its negative relationship with depressive symptoms (Ryan & Frederick, 1997). However, subjective vitality is considered to be a renewable form of affect and may be revived with the assistance of positive antecedents (Lavrusheva, 2020). In a sporting context, there has been little prior research that has examined the relationship between stress and vitality, however, it can be proposed that a similar relationship will exist in that greater stress is likely to be associated with lower vitality. The nature of competition in sport means that the outcomes of athletic endeavours are uncertain. The uncertainty in sport means that it is not possible to avoid stress (Jamieson et al., 2016) and athletes will always encounter stressful situations as part of their pursuits, particularly in motivated performance situations as they assess the demands of the situations and their perceived resources to meet those demands (Meijen et al., 2020). Therefore, it is important that research seeks to investigate factors that relate to stress and athletes’ psychological wellbeing, such as depressive symptoms and vitality.

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Research suggests that it is not simply experiencing stress that has a detrimental effect on our psychological wellbeing, but rather how stressful situations are viewed and appraised is likely to be of equal importance (Lazarus & Folkman, 1984). Rational Emotive Behaviour Therapy (REBT; Ellis & Dryden, 2007) offers support for this notion by theorizing that beliefs play a key role in determining the responses that an athlete experiences in a stressful situation, thus influencing cognitive appraisals about an event. As the environment of sport frequently places athletes under conditions of stress, it would appear logical to examine how appraising stress is associated with depression and vitality. Two types of stress appraisal are challenge and threat, which are responses to performance situations of personal significance suggested in the Theory of Challenge and Threat States in Athletes (TCTSA; Jones et al., 2009); and the revised version of the TCTSA (TCTSA-R; Meijen et al., 2020). When an athlete perceives that the competition is relevant to the athlete's goals and that the conditions are favourable for success, they will appraise the scenario as a challenge (Meijen et al., 2020), such as a sprinter believing that they can win an important race. Conversely, an athlete who considers the competition to be relevant but deems the conditions to be unfavourable for success will appraise the scenario as a threat (Meijen et al., 2020). For example, when a tennis player believes that they are not capable of beating an opponent in a forthcoming tournament. Perceptions of resources being able to meet the demands of a situation are thought to be determined by levels of self-efficacy, perceived control, and approach or avoidance goal focus, whilst predispositions such as trait appraisals (Skinner & Brewer, 2002) and irrational beliefs (David et al., 2002) are also considered to influence state challenge and threat. Specifically, 'high challenge' is experienced when individuals feel efficacious, in control, and focus on approach goals (Meijen et al., 2020). Athletes who appraise a stress-evoking situation as a challenge in turn experience more adaptive responses such as positive emotions and if negative emotions are experienced, these are perceived as being facilitative for performance (Meijen et al., 2020). Those who appraise the same situation as a threat experience negative emotions (Doron & Martinent, 2017; Meijen et al., 2020) or emotions which are more debilitating to performance (Williams et al., 2017). Building on previous research by Jones et al. (2009), researchers have recently suggested that it is possible to be experiencing both challenge and threat simultaneously (Uphill et al., 2019) and that challenge and threat may instead be described using a  $2 \times 2$  theory of high challenge, low challenge, high threat and low threat (Meijen et al., 2020). In attempting to explain the mechanism behind this relationship, individuals who appraise stressful situations as a challenge see an opportunity for growth and mastery, which can in turn positively influence levels of psychological wellbeing (Adie et al., 2008). In addition to the proposals of the TCTSA (Jones et al., 2009), the TCTSA-R (Meijen et al., 2020) aligns with REBT in suggesting that an athletes' beliefs may also play a role in determining cognitive appraisals. With that in mind, it is important to identify dispositions likely to be associated with athletes' general challenge and threat appraisal tendencies due to the relationship these could have on general psychological wellbeing.

Beliefs, or the views that we adopt for oneself (Dweck, 2017), are said to be a key factor in influencing the psychology of an individual towards a stressful event. One such type of belief likely to be associated with appraisals of stressful events is stress mindset. Rather than focusing on the amount or intensity of stress (Crum et al., 2017), stress mindset refers to the extent to which an individual holds the trait belief that stress has enhancing or debilitating consequences on stress-related outcomes (Crum et al., 2013). For instance, an individual may believe that stress has positive or negative benefits in areas such as health, productivity, wellbeing and performance (Crum et al., 2013). Such beliefs about stress are considered to be part of higher-level belief systems and are general in nature compared to more situation-specific appraisals (Jamieson et al., 2018). While stress has traditionally been viewed negatively, more recent research supports the notion that stress can be perceived positively and used constructively (e.g., Crum et al., 2013;

Jamieson et al., 2016) and differs from resilience and hardiness approaches to stress as they reaffirm the notion that stress needs to be managed or reduced rather than used in a facilitatory capacity (Crum et al., 2013). Indeed, a 'stress-is-enhancing' mindset, where an individual embraces stressful situations and sees them as an opportunity to learn (Park et al., 2018), is thought to have beneficial effects on health and wellbeing (Crum et al., 2013). For instance, Skinner and Brewer (2002) reported that positive appraisals of stressful events are associated with positive emotions, whereas individuals who hold rigid beliefs that stressful situations are negative occurrences typically experience lower levels of vitality compared to those who interpret stressful situations as facilitative (Park et al., 2018).

In non-athlete populations a 'stress-is-enhancing' mindset has been found to increase levels of positive emotions (Crum et al., 2017) and proactive coping behaviours (Keech et al., 2018). Additionally, a 'stress-is-enhancing' mindset has been shown to positively relate with challenge in employees anticipating high-workload situations (Casper et al., 2017) and a mathematics competition (Hangen et al., 2019). Perhaps this increase in positive emotions under stressful circumstances is due to a 'stress-is-enhancing' mindset giving an individual more belief that they can succeed in such situations as they have more positive expectations of coping with the stressor (Jones, 1995). In turn, as self-efficacy is known as a key antecedent of challenge (Skinner & Brewer, 2002; Turner and Barker, 2013), an individual may be more likely to adopt a challenge approach to a stress situation if they hold a 'stress-is-enhancing' mindset.

Research has also found links between depressive symptoms and stress mindset (Crum et al., 2013). Specifically, a 'stress-is-enhancing' mindset has been associated with lower levels of depressive symptoms and higher levels of wellbeing (Crum et al., 2013; Jiang et al., 2019). In contrast, students who held 'stress-is-debilitating' mindsets were significantly more likely to have increased levels of depressive symptoms than those who held 'stress-is-enhancing' mindsets (Huebschmann & Sheets, 2020). In terms of athlete populations, there is little known research that examines the relationships between stress mindset and psychological wellbeing. Recent work by Smith et al. (2020) in US Navy SEALs shows some promise that stress mindset can be an important factor in stressful athletic situations by demonstrating that a 'stress-is-enhancing' mindset can influence levels of performance and persistence, possibly by improved physiological responses to stressors, such as by improved cortisol reactivity profiles (Crum et al., 2013). This finding suggests that stress mindsets in athletes may play an important role in psychological wellbeing.

Irrational beliefs are another factor which have been found to influence affect in athletes by interacting with challenge and threat when considered through a Lazarusian perspective (Chadha et al., 2019). Irrational beliefs are rigid, extreme and inflexible beliefs comprised of a primary irrational belief (demandingness) and three secondary beliefs (self-depreciation, low frustration tolerance, and awfulizing; Turner et al., 2019b). Demandingness is characterised by absolute expressions, such as 'must win' and 'have to', self-depreciation refers to negative evaluations applied to oneself, low frustration tolerance is concerned with a belief of an inability to tolerate the conditions of adversity (Bennett & Turner, 2018), and awfulizing includes beliefs that consider unpleasant events to be the worst that they could be (Dryden & Neenan, 1995). From a REBT viewpoint, individuals hold the view that adversity (e.g., failure in a sporting competition) is inevitable. When faced with such situations, individuals with irrational beliefs will experience unhealthy negative emotions (e.g., depression) and behaviours that are unhelpful (e.g., avoidance) in the pursuit of athletic success (Visla et al., 2016). In contrast, according to binary constructs of emotional distress (Ellis, 1962), low levels of irrational beliefs are said to be associated with low levels of dysfunctional negative feelings and high levels of functional negative feelings when faced with a stressful situation (David et al., 2005). Indeed, rational beliefs are more logical, non-extreme and flexible and are considered to promote positive levels of psychological

wellbeing (Turner, 2016). REBT is based on the ABC(DE) framework (Ellis & Dryden, 2007), where practitioners assist individuals by helping them to recognise that the adversity they face (A) does not cause emotional and behavioural responses alone (C), instead, it is their beliefs (B) about the situation (A) that helps determine their response (C). With this in mind, it is possible to suggest that stress mindset and REBT are theoretically closely aligned and that a ‘stress-is-debilitating’ mindset may be an irrational belief in itself about stress. Both a ‘stress-is-debilitating’ mindset and other irrational beliefs share the distinction of being meta-emotional disturbances, that is emotional disturbance about emotional disturbances (Dryden & Branch, 2008), and individuals who possess ‘stress-is-debilitating’ mindsets may reflect irrational beliefs in that their beliefs about stress are fixed, illogical and extreme. REBT posits that it is an individual’s beliefs about what happens to them that causes stress and not stress alone (Dryden & Branch, 2008). Therefore, in the case of individuals who possess ‘stress-is-debilitating’ mindsets and other irrational beliefs, an REBT theoretical approach seeks to promote cognitions that are B to C in nature to reduce emotional disturbances and encourage positive cognitive reappraisal. To summarise, both stress mindset and irrational beliefs theories are linked closely to REBT in that in both areas, an individual’s dysfunctional responses (C) are formulated as a result of rigid and extreme beliefs (B) held about adversity (A).

There is growing recent evidence to suggest how the complex interactions of irrational beliefs and challenge and threat may influence affective states (Chadha et al., 2019), which in turn may influence athletic performance and wellbeing. It is thought that primary appraisals about the demands of the task and secondary appraisals of an individual’s perceived possession of resources to cope with said demands may link irrational beliefs to appraisals (Evans et al., 2018). In support, irrational beliefs have been shown to be positively associated with threat in specific sporting contexts (Dixon et al., 2017; Evans et al., 2018; Chadha et al., 2019) and negatively with challenge (Chadha et al., 2019), perhaps due to having negative expectations about future events. In turn, research has shown that athletes who experience higher threat are also more likely to interpret stress responses as debilitating towards performance (Chadha et al., 2019). Importantly for practitioners, recent research has demonstrated that athletes who experienced a reduction in irrational beliefs also experienced an increase in self-efficacy (Chrysidis et al., 2020; Wood et al., 2017) – situational specific self-confidence - which may assist athletes in developing challenge appraisals. Literature from both sport and outside of sport also demonstrates that irrational beliefs are associated with depressive symptoms (Flett et al., 2008; Turner et al., 2019b; Visla et al., 2016) and can influence stress appraisals (i.e., challenge and threat) to alter emotions and anxiety

(Chadha et al., 2019). In athletes, irrational beliefs have been found to relate to depressive symptoms through dysfunctional perceptions in the form of maladaptive schemas that are activated in relevant situations (Turner, Aspin, & Gillman, 2019). Therefore, challenge and threat appraisals are proposed to be two more cognitions that indirectly associate irrational beliefs with depressive symptoms and vitality.

### 1. Aims and hypothesis

Despite the likely importance of athlete stress mindset and other irrational beliefs on depressive symptoms and vitality, there is no known research that examines how these variables are associated in an athlete population, and whether challenge and threat appraisals have an effect on these relationships. Therefore, the aims of the present study were to investigate the extent to which athletes’ stress mindset and other irrational beliefs were associated with their depressive symptoms and vitality, and whether these relationships were influenced through challenge and threat tendencies. As displayed in Fig 1, it was hypothesised that stress mindset would be positively associated with a challenge appraisal tendency and negatively associated with a threat appraisal tendency. Irrational beliefs were hypothesised to have the reverse associations with the same variables. Challenge and threat appraisal tendencies were predicted to relate to depressive symptoms positively and negatively respectively and were predicted to relate to vitality negatively and positively respectively. Furthermore, indirect associations between stress mindset (negatively to depressive symptoms and positively to vitality) and other irrational beliefs (positively to depressive symptoms and negatively to vitality) were proposed to operate through challenge and threat appraisal tendencies. It was also hypothesised that the relationship between vitality and depressive symptoms would be bi-directional and that these associations would be negative.

Additionally, previous research has identified gender and age differences in beliefs, appraisals and psychological wellbeing (e.g. Mak et al., 2004). Therefore, the present study also examined any gender and age differences in stress mindset, irrational beliefs, challenge, threat, depressive symptoms and vitality. It was proposed that males would possess greater levels of stress mindset, challenge appraisal, and vitality than females, with females possessing higher irrational beliefs, threat and depressive symptoms than males. It is also hypothesised that age would have a negative relationship with, irrational beliefs, threat appraisal, depressive symptoms and vitality, and a positive relationship with stress mindset and challenge appraisal.

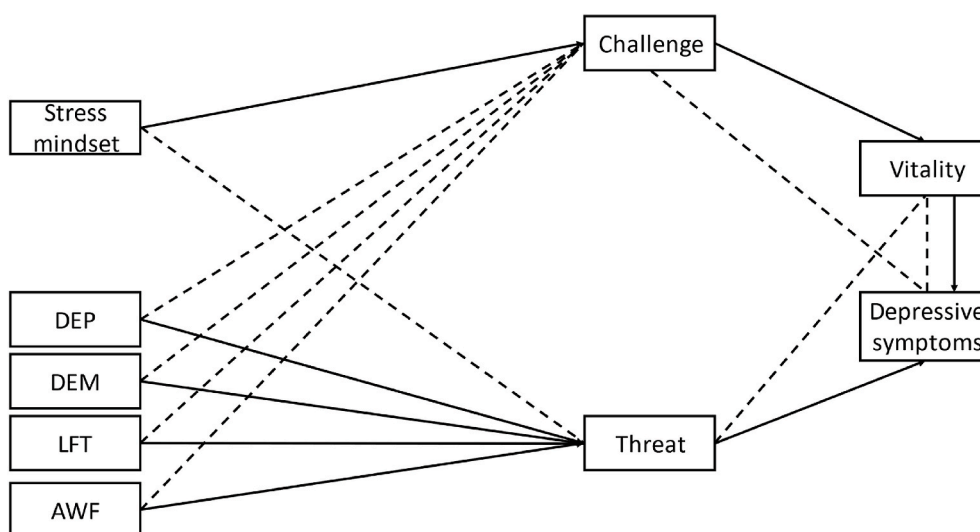


Fig. 1. Hypothesised Model. Note. Dashed lines represent negative associations and unbroken lines represent positive associations.

## 2. Method

### 2.1. Participants

Four hundred and fifteen athletes ( $n = 227$  females,  $n = 183$  males,  $n = 5$  other,  $\text{Mage} = 33.86$  years,  $\text{SD} = 17.73$ ) participated in the study. Following ethical approval from the author's university ethics committee, participants were recruited locally through advertisements on campus and throughout the UK by sending emails to sports clubs. The study was also promoted via social media channels such as Facebook and Twitter. Recruited athletes represented fifty different team and individual sports including running ( $n = 84$ ), football ( $n = 48$ ) and roller derby ( $n = 26$ ). The competitive level of the athletes included recreational ( $n = 169$ ), local club/university ( $n = 164$ ), regional ( $n = 36$ ), semi-professional ( $n = 15$ ), national ( $n = 17$ ), and international ( $n = 14$ ), and athletes had taken part in their main sport for an average of 13.14 years ( $\text{SD} = 11.54$ ). Exclusion criteria included not currently experiencing any injuries preventing them from taking part in their sport in the last two weeks, and having no medically diagnosed mental health conditions. Inclusion criteria were that athletes were at least eighteen years of age and took part in a sport.

### 2.2. Measures

**Stress mindset.** Stress mindset was assessed using the 8-item unidimensional Stress Mindset Measure - General (SMM-G; Crum et al., 2013). Four statements emphasise more of a stress-is-enhancing mindset (e.g., "Experiencing stress enhances my performance and productivity"), and four statements represent a stress-is-debilitative mindset (e.g., "The effects of stress are negative and should be avoided"). Participants rated how strongly they agreed with each of the eight statements on a 4-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree). Negatively worded items are reverse scored and then all 8 items are averaged together on one subscale so that the higher the value, the more on a continuum an individual is considered to possess a stress-is-enhancing mindset. The SMM was reported to produce valid and reliable stress mindset scores (Crum et al., 2017). The Cronbach alpha coefficient in the present study was 0.87, indicating high levels of internal reliability.

**Irrational beliefs.** The irrational performance beliefs inventory (iPBI; Turner et al., 2016) was used to assess irrational beliefs. The 28-item scale assessed four subscales including Demandingness (DEM; e.g., "I have to be viewed favourably by people that matter to me"), Low Frustration Tolerance (LFT; e.g., "I can't stand not reaching my goals"), Awfulizing (AWF; e.g., "It is appalling if others do not give me chances") and Self-depreciation (DEP; e.g., "If I face setbacks, it goes to show how stupid I am"). Participants rate the extent to which they agree/disagree with each statement on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (totally agree). Questions have been previously developed for a sports setting (e.g., "It would be awful if my position in the team was not secure"; Turner & Allen, 2018). The scale was also deemed suitable for this study due to its previously reported validity and reliability (Turner & Allen, 2018). Cronbach alpha coefficients in this study indicated high levels of reliability and were recorded for each subscale: DEM,  $\alpha = 0.78$ ; LFT,  $\alpha = 0.87$ ; AWF,  $\alpha = 0.83$  and DEP,  $\alpha = .91$ .

**Challenge and threat.** The Challenge and Threat in Sport Scale (CAT-Sport Scale; Rossato et al., 2018) was used to assess athletes' experiences of challenge and threat in anticipation of competition. The CAT-Sport Scale is a 12-item questionnaire with 5 items assessing challenge (e.g., "A challenging situation motivates me to increase my efforts") and 7 items assessing a threat (e.g., "I feel like competing in my sport is a threat"; Rossato et al., 2018). Participants indicate the extent to which agree or disagree with each statement by responding on a 7-point Likert scale ranging from 1 (totally disagree) to 7 (totally agree). Mean scores are generated for challenge and threat subscales. The Cronbach alpha coefficient in the present study was 0.84 for challenge

and 0.94 for threat, indicating high levels of internal reliability (Rossato et al., 2018). The scale has also been recently used in other similar studies (Chadha et al., 2019).

**Depressive symptoms.** The Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) was designed to assess the mental health of an individual, with 9 items taken from the original 36 to assess symptoms of depression. Participants are asked to consider how frequently they have been bothered by things over the last two weeks. Nine items include things like "Little interest or pleasure in doing things" and "Feeling down, depressed or hopeless". Responses are made on a 4-point Likert scale ranging from 0 (not at all) to 3 (nearly every day). Scores are then summed with higher scores therefore indicating higher levels of depressive symptoms. The PHQ-9 has been found to be a valid and reputable measure of depression severity (Kroenke et al., 2001) and has been used recently in other studies that measure the association between depressive symptoms and irrational beliefs (e.g. Turner, Aspin, & Gillman, 2019a; Turner, Carrington, & Miller, 2019b). The Cronbach alpha coefficient in the present study was 0.88, indicating high levels of internal reliability.

**Vitality.** Participants' feelings of positive affect and personal energy were measured using the Subjective Vitality Scale (SVS; Ryan & Frederick, 1997). Seven items are included in total (e.g., "I look forward to each new day") in which participants indicate the degree to which each statement is true for them in general in their life. Responses are made on a 7-point Likert scale, ranging from 1 (not at all true) to 7 (very true). One item ("I don't feel very energetic") was reverse-coded and all items are then summed so that a higher score indicates a greater subject vitality. The Cronbach alpha coefficient in the present study was 0.91, indicating high levels of internal reliability. The SVS has also previously been found to demonstrate high internal reliability ( $\alpha = 0.93$ ; Rouse et al., 2015; Fenton et al., 2018) and has been used other recent relevant studies (Davis & Turner, 2020).

### 2.3. Procedures

Data collection took place for five months from April 2019–August 2019. Potential participants were provided with an information sheet about the study, including inclusion/exclusion criteria, details of key ethical considerations such as data confidentiality and their freedom to withdraw at any time. After providing informed consent, participants completed an online questionnaire pack containing the SMM, iPBI, CAT-Sport, PHQ-9 and SVS. Overall, the questionnaire pack took about 20 minutes to complete and participants were thanked for taking part in the study upon completion.

### 2.4. Data analyses

Data were screened and cleaned in SPSS (IBM, version 26). Three participants did not complete the questionnaire pack and were removed from the data. The remaining data contained less than 5% of missing responses. Little's MCAR Test demonstrated that this data was missing at random ( $p > .05$ ), so the expectation maximisation method was employed to complete the data set (Tabachnick & Fidell, 2013). Next, data were checked for outliers and normality. The process of checking for outliers revealed no univariate or multivariate outliers when using Mahalanobis distance at  $p < .001$  (Tabachnick & Fidell, 2013). The final sample consisted of 415 participants (female  $n = 227$ , male  $n = 183$ , other  $n = 5$ ).

To check that the questionnaire data was valid and reliable, confirmatory factor analysis (CFA) using AMOS (version 26) was conducted on all questionnaires to assess fit indices for all the questionnaires (see Table 1). Cronbach alpha co-efficients were conducted on all questionnaire subscales along with chi-square ( $\chi^2$ ; Jöreskog & Sörbom, 1993) and degrees of freedom, comparative fit index (CFI), Tucker Lewis fit index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR).

**Table 1**  
Confirmatory factor analysis fit indices for the questionnaires employed the in the study.

	$\chi^2$	CFI	GFI	SRMR	RMSEA (90% CI)	Composite Reliability	Average Variance Extracted
SMM-G	129.17	.918	.927	.047	.115 (.096–.134)	2.143	0.857
iPBI	1218.29	.851	.820	.072	.078 (.074–.083)	–15.73	1.597
CAT-Sport	261.67	.950	.898	.075	.098 (.086–.109)	0.993	1.001
PHQ-9	127.42	.936	.935	.028	.095 (.079–.112)	2.485	0.835
SVS	120.95	.944	.921	.084	.136 (.114–.159)	-.961	1.280

Descriptive statistics were calculated, and one-way ANOVAs were conducted to see whether there were any gender differences in the different variables of interest (i.e., stress mindset, irrational beliefs (demandingness, self-depreciation, low frustration tolerance and awfulizing), challenge and threat, depressive symptoms, and vitality) due to gender differences in previous research (e.g. Mak et al., 2004). Next, Pearson’s correlations were conducted to test for associations between these different variables of interest. In the case of correlational analysis between age and the variables of interest,  $R^2$  values were also calculated to reduce bias towards p values (Zhu, 2012). The findings were also used to determine that gender and age should be controlled for when testing the hypothesised model. Based on literature highlighting more elite athletes are better able to employ psychological skills to guard against the debilitating effects of stressful situations compared to lower level athletes or non-athletes (e.g., Hagan et al., 2017; Neil et al., 2006), competitive level was controlled for in the hypothesised model. For visual simplicity, gender, age and competitive level are not displayed in Fig 2.

The hypothesised model was tested using path analysis in AMOS (version 26) to determine how stress mindset and other irrational beliefs were associated with depressive symptoms and vitality through challenge and threat. The goodness of fit in the model and the CFA were examined using the chi square likelihood statistic ratio ( $\chi^2$ ; Jöreskog & Sörbom, 1993). Additionally, the CFI and the TLI were used as measures of incremental fit, with values of  $\geq 0.95$  and  $\geq 0.90$  demonstrating an excellent model fit (Hu & Bentler, 1999). Furthermore, the RMSEA and SRMR were chosen as indices of absolute model fit, where criteria of  $\leq 0.05$  and  $\leq 0.08$  reflected excellent and adequate model fit respectively (Hu & Bentler, 1999; Byrne, 2010). Similar measures of model fit were also used in other comparable studies (Chadha et al., 2019; Williams & Cumming, 2011). Based on recommendations by Byrne (2010) in cases of poor model fit, modification indices were examined and meaningful covariances with larger regression weights were considered

and included into subsequent iterations of the proposed model. Standardized regressions were reported for all direct and indirect effects. Indirect effects were examined using 95% bias-corrected confidence intervals generated from bootstrapping of 1000 samples.

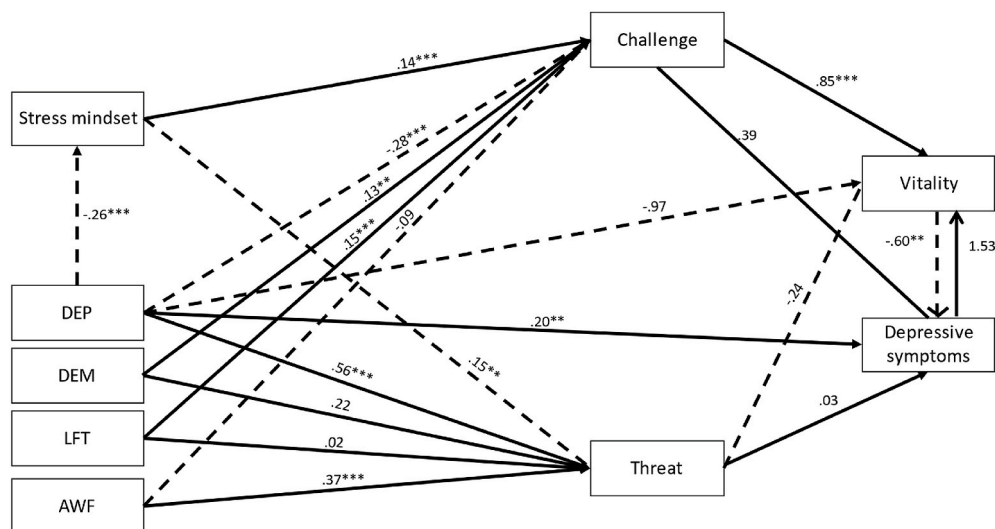
### 3. Results

#### 3.1. Validity and reliability of measures in the present study

Results for all CFAs are reported in Table 1 and indicate a largely adequate fit to the data. When compared to the present study, the SMM-G (Karampas et al., 2020), iPBI (Turner & Allen, 2018) and the CAT-Sport (Rossato et al., 2018) have been found to have very similar fit indices to the present study.

#### 3.2. Descriptive statistics and gender differences

Participant characteristics depicting gender differences are reported in Table 1. A one-way ANOVA revealed that males recorded significantly higher vitality than females  $F(1, 408) = 5.67, p < .020, \eta^2 = 0.01$ . Separate one-way ANOVAs also revealed that there were no significant gender differences in stress mindset or depressive symptoms. Additionally, multivariate analysis was employed to assess further gender differences. A one-way MANOVA revealed a significant difference at the multivariate level, Pillai’s trace = 0.02,  $F(2, 407) = 4.62, p = .010, \eta^2 = 0.02$ . Results of the follow-up univariate ANOVA analysis revealed significant mean differences in challenge ( $p = .007$ ) when comparing male scores ( $M = 4.88, SD = 0.67$ ) with female scores ( $M = 4.68, SD = 0.77$ ). Significant mean differences were also found in threat ( $p = .022$ ) when comparing male scores with female scores (see Table 1 for mean scores). A one-way MANOVA revealed irrational beliefs differed between males and females, Pillai’s trace = 0.03,  $F(4, 405) = 3.36, p = .01, \eta^2 = 0.03$ . Results of the follow-up univariate analysis revealed significant mean



**Fig.2.** Path analysis testing the revised model for the effect of beliefs on depressive symptoms and vitality. Note: Full lines denote positive relationships and dashed lines denote negative relationships. Numbers refer to standardized beta values. DEP = Self-depreciation, DEM = Demandingness, LFT = Low Frustration Tolerance and AWF = Awfulizing. \* =  $p < .05$ , \*\* =  $p < .01$ , \*\*\* =  $p < .001$

differences in self-depreciation ( $p = .005$ ), demandingness ( $p = .003$ ), low frustration tolerance ( $p = .026$ ), and awfulizing ( $p < .001$ ), with women reporting higher mean scores than men on all four subscales.

### 3.3. Associations with age

Correlation analysis of the relationships between the key variables and age are displayed in Table 2. Similar to research by Turner and Moore (2016), age was shown to have a significant negative relationship with, self-depreciation, demandingness, low frustration tolerance and awfulizing. Age was also shown to have a significant negative relationship with stress mindset, threat and depressive symptoms. In contrast, age was significantly positively correlated with vitality. There was no significant correlation between age and challenge (see Table 3).

### 3.4. Model

Path analysis revealed that the initial model did not demonstrate an acceptable fit to the data  $\chi^2(19) = 144.52, p < .05, GFI = 0.95, TLI = 0.74, RMSEA = 0.13$  (CI = 0.11 to 0.15) SRMR = 0.12. Modification indices recommended three additional paths from self-depreciation to stress mindset, depressive symptoms, and vitality. These pathways were considered to make sense conceptually and reflect notions from the literature so were subsequently added to the hypothesised model. In recent studies involving athletes, interventions which decreased self-depreciation also increased levels of self-efficacy (Chrysidis et al., 2020) whilst self-depreciation has also been reported to have a positive relationship with depressive symptoms (Turner et al., 2019a,b).

Following these iterations, the revised model demonstrated an excellent fit to the data  $\chi^2(16) = 38.83, p = .001, GFI = 0.98, TLI = 0.94, RMSEA = 0.06$  (CI = 0.04 to 0.08), SRMR = 0.04. The standardized path coefficients for each individual path are displayed in Fig 2, demonstrating patterns largely consistent with study hypotheses. Squared multiple correlation ( $R^2$ ) scores offered additional support for the strength of fit of the data to the proposed model. Stress mindset was found to account for 21% variance in challenge ( $p < .001$ ) and 10% variance in threat ( $p = .010$ ). Self-depreciation was found to account for 26% total variance in stress mindset ( $p < .001$ ), 44% of total variance in challenge ( $p < .001$ ), 38% variance in threat ( $p < .001$ ) and 23% variance in depressive symptoms ( $p < .001$ ). The other irrational belief subscales were also found to influence levels of key variables. Demandingness was responsible for 15% variance in challenge ( $p = .015$ ), low frustration tolerance was responsible for 21% variance in challenge ( $p < .001$ ) and awfulizing was responsible for 20% variance in threat ( $p = .001$ ). Finally, challenge was responsible for 40% variance in vitality ( $p < .001$ ). Non-significant paths were found between

**Table 2**  
Participant characteristics and gender differences.

	Mean/Total (SD)	Range	Males Mean (SD)	Females Mean (SD)
Stress mindset	2.04 (0.70)	0.13–3.75	2.11 (0.69)	1.99 (0.70)
DEP	15.26 (5.71)	7–34	14.38 (5.36)**	14.96 (5.98)
DEM	25.25 (4.22)	9–35	24.56 (4.72)**	25.80 (3.68)
LFT	24.04 (5.12)	8–35	23.41 (5.67)*	24.55 (4.58)
AWF	22.70 (4.68)	7–35	21.84 (5.04)**	23.39 (4.26)
Challenge	4.77 (0.74)	11–30	4.88 (0.67)*	4.68 (0.77)
Threat	3.12 (1.23)	7–40	2.95 (1.21)*	3.23 (1.24)
Depression	5.13 (4.99)	0–24	4.78 (4.90)	5.42 (5.06)
Vitality	4.80 (1.12)	1–7	4.94 (1.08)*	4.68 (1.14)

Note. <sup>a</sup>Degrees of freedom = 408, DEP = Self-depreciation, DEM = Demandingness, LFT = Low Frustration Tolerance and AWF = Awfulizing. \* = difference is significant at the 0.05 level (sig. 2 tailed), \*\* = difference is significant at the 0.005 level (sig. 2). Participants who identified their gender as 'other' were not included in this analysis due to the number of people in this group not being comparable to the numbers in the other groups to conduct the relevant analyses of variance

**Table 3**  
Age correlations with key variables.

	Pearson Correlation	R <sup>2</sup>
Stress mindset	-.108*	-.012
DEP	-.281***	-.079
DEM	-.123*	-.015
LFT	-.406***	-.016
AWF	-.236***	-.056
Challenge	-.026	-.001
Threat	-.312***	-.100
Depressive symptoms	-.260***	-.067
Vitality	.114*	.013

Note. DEP = Self-depreciation, DEM = Demandingness, LFT = Low Frustration Tolerance and AWF = Awfulizing. \* =  $p < .05$ , \*\* =  $p < .01$ , \*\*\* =  $p < .001$

demandingness and threat, low frustration tolerance and threat, awfulizing and challenge, challenge and depressive symptoms, threat with both depressive symptoms and vitality, and depressive symptoms to vitality.

Results of the indirect effects demonstrated that stress mindset was found to have a significant indirect effect on depressive symptoms ( $\beta = -0.07, p = .002, 95\% CI = -0.10$  to  $-0.03$ ) through challenge, threat and vitality, and on vitality ( $\beta = 0.15, p = .002, 95\% CI = 0.09$  to  $0.21$ ) through challenge, threat and depressive symptoms. Self-depreciation had a significant indirect effect on depressive symptoms through stress mindset, challenge, threat and vitality ( $\beta = 0.18, p = .002, 95\% CI = 0.12$  to  $0.25$ ) and on vitality through stress mindset, challenge, threat and depressive symptoms ( $\beta = -0.36, p = .002, 95\% CI = -0.47$  to  $-0.26$ ). Low frustration tolerance had a significant indirect effect on vitality through challenge, threat and depressive symptoms ( $\beta = 0.14, p = .007, 95\% CI = 0.05$  to  $0.23$ ). Awfulizing was found to have a significant indirect effect on depressive symptoms through challenge, threat and vitality ( $\beta = 0.10, p = .009, 95\% CI = 0.03$  to  $0.17$ ), and on vitality ( $\beta = -0.15, p = .020, 95\% CI = -0.26$  to  $-0.02$ ) through challenge, threat and depressive symptoms. No other irrational beliefs were found to have a significant indirect effect on the other variables in the model.

In summary of the model, the data demonstrates that self-depreciation is the type of irrational belief that has the greatest association with appraisals and depressive symptoms directly and with depressive symptoms and vitality indirectly through stress mindset and appraisals. Awfulizing was also found to associate with depressive symptoms indirectly, through challenge, threat and vitality. Additionally, stress mindset demonstrated variances in challenge and threat directly and had significant indirect effects on depressive symptoms through challenge, threat and vitality and on vitality through challenge, threat and depressive symptoms. Overall, the results showed that both beliefs and appraisals related to depressive symptoms and vitality to different extents.

## 4. Discussion

The aims of the present study were to assess the extent that stress mindset and other irrational beliefs related to psychological wellbeing through the direct and indirect effects of stress appraisals in athletes. Athletes' stress mindset was found to have a significant positive relationship with challenge and a significant negative relationship with threat. This supports previous studies in general population samples demonstrating stress mindset relates to challenge (e.g., Kilby & Sherman, 2016). As hypothesised, stress mindset was indirectly associated with greater vitality and the present study is the first to show that this relationship occurs specifically through challenge, threat and depressive symptoms. The link between challenge and psychological wellbeing is well-established in the literature (e.g., Mak et al., 2004; Adie et al., 2008), and one explanation for the relationships demonstrated in the present study is that a 'stress-is-enhancing' mindset can increase perceived coping resources (Keech et al., 2018), which can subsequently

enhance levels of challenge and psychological wellbeing. Considering stress mindset as a trait-level belief about the extent to which stress can be facilitative or debilitating (Crum et al., 2013), the finding that stress mindset is positively related to challenge is also supported by the TCTSA-R (Meijen et al., 2020), where predispositions were highlighted as being a key factor in influencing appraisals. The present study adds to this literature by demonstrating that if an athlete has a 'stress-is-enhancing' mindset, they are more likely to report higher challenge and psychological wellbeing.

Supporting the hypothesis, the negative relationship between stress mindset and threat was significant in athletes. In non-athlete samples, previous research has produced mixed results in relation to stress mindset and threat, and it has been proposed that if employees hold a 'stress-is-debilitating' mindset, they might appraise specific stressful situations as a threat and make fewer approach-coping efforts (Casper et al., 2017). However, more recent research found that 'stress-is-debilitating' instructions did not elicit a greater degree of threat in a laboratory-based competition compared to a control group (Hangen et al., 2019). Future research should ascertain whether the relationship between stress mindset and threat is evident at both trait-level and immediately prior to a stressful event, such as a sporting competition. In addition, subsequent research should examine the role stress mindset plays in sporting performance and whether this differs between recreational and professional athletes or those who take part in individual sports compared to team sports. Future research in this area may also test the value of stress mindset in differing conditions of stressor intensity.

Partly as hypothesised and consistent with REBT theory (Evans et al., 2018), some irrational beliefs were positively associated with threat, with subscales except demandingness and low frustration tolerance relating. This supports recent work by Meijen et al. (2020), who stated as part of the TCTSA-R that predispositions such as irrational beliefs are one of the main drivers of subsequent appraisals. Previous studies have demonstrated that greater irrational beliefs are associated with a greater tendency to appraise stress as a threat (Chadha et al., 2019; Dixon et al., 2017; Evans et al., 2018). Thoughts that include absolute expressions such as negative beliefs about oneself (self-depreciation) and considering unpleasant events to be the worst that they can be (awfulizing) may all contribute to an athlete not believing that they have the resources to cope with the demands of a task, subsequently leading to a threat appraisal (Skinner & Brewer, 2002). In support of Chadha et al. (2019), fewer negative associations were revealed between irrational beliefs and challenge. This relationship could be explained as there was no imminent stressful situation such as a sporting competition (Chadha et al., 2019). Furthermore, the binary theory of emotional distress (Ellis, 1962) may explain why the relationships between irrational beliefs were stronger with threat than challenge. Challenge and threat have also been considered to be a binary concept, which draws parallels with suggestions based on REBT theory, whereby an individual may hold either rigid or flexible beliefs (Dryden, 2021). Therefore, measuring both irrational beliefs and rational beliefs, such as unconditional acceptance attitudes (Dryden, 2021), may be useful in further demonstrating relationships between irrational beliefs, challenge and threat in future research. Contrary to the hypothesis, demandingness and low frustration tolerance were significantly associated with greater challenge appraisal. Although there is a plethora of research with supports the detrimental effects of irrational beliefs on psychological wellbeing (e.g., Visla et al., 2016), there are also some studies that have concluded that irrational beliefs may enhance athletic performance (e.g., Wood et al., 2017). It has been proposed that irrational beliefs can be useful in achieving short term goals (Mesagno et al., 2020), although there is no known research that has confirmed positive relationships between demandingness and low frustration tolerance with challenge specifically. The reasons behind this relationship in the present study are unclear and future research may wish to further explore the relationships between demandingness, low frustration tolerance and challenge in athletes. Taken together,

these findings suggest that challenge and threat may not be opposite ends of a continuum (Uphill et al., 2019), and that there may be nuances in the relationships between the individual irrational beliefs with challenge and threat.

One finding which was not expected and contradicted the originally hypothesised model was the prominence of self-depreciation in directly predicting additional variables in the model, as the analysis identified additional associations of self-depreciation also predicting stress mindset and depressive symptoms. Self-depreciation irrational beliefs have been reported to be an important factor in determining affect in students (Allen et al., 2017), a key area to target in psychological interventions with athletes (Cunningham & Turner, 2016), and have also been found to positively relate to athlete's psychological illbeing in previous studies (e.g., Turner et al., 2019b). However, in the present study, the strength of self-depreciation's relationships with challenge and threat was also considerably greater than the other three types of irrational beliefs, exhibited by higher beta scores of at least a medium effect size in each relationship. This was despite the mean scores for self-depreciation being lower than the other three types of irrational beliefs. The lower self-depreciation mean scores may be explained by how self-depreciation differs to awfulizing and low frustration tolerance in that thoughts such as "I am a complete failure" are final and refer to the self, whilst the other irrational beliefs tend to evaluate outside events, such as "It's awful if others do not approve of me". The link between self-depreciation and threat is likely to be explained by the self-downing nature of such beliefs, which may also be reflected in some of the items in the threat subscale of the CAT-Sport questionnaire (e.g., "I get concerned that others will find fault with me"). Self-depreciating irrational beliefs hold negative evaluations of oneself as a central tenet, for example, equating a defeat with being a loser as a person (Wood & Turner, 2020). As setbacks may be attributed internally in the form of self-blame, this may lead to additional threat appraisals being made due to individuals experiencing greater degrees of worry about an event or how they are perceived by others. Furthermore, self-depreciating beliefs are said to be unhealthy and dysfunctional leading to depressive symptoms (Bennett & Turner, 2018) which likely explains the direct association in the present study between self-depreciation and depressive symptoms. This relationship is supported by REBT theory (Dryden, 2021) and previous studies (e.g., Buschmann et al., 2018), and is particularly salient in athletic populations as they will be certain to encounter adversity in their careers, thus risking the development of depressive symptoms if the athlete holds self-depreciating beliefs (Cunningham & Turner, 2016). The present study emphasizes the importance of self-depreciation's associations with beliefs, appraisals of stress, and psychological wellbeing in athletes. Practitioners could assess self-depreciation in athletes and employ interventions where required to promote more rational beliefs through strategies targeting unconditional acceptance (Wood & Turner, 2020) by accepting that if they do fail in their sporting endeavors, they are not therefore a failure (Turner et al., 2019b).

Not entirely as hypothesised, an interesting finding was that the positive stress appraisal (i.e., challenge) predicted the wellbeing outcome (i.e., vitality) whereas there were no significant relationships between challenge and depressive symptoms and threat with either depressive symptoms or vitality. This is partially supported by previous research which found no association with challenge and depressive symptoms but is also in contrast to previous findings of a positive association between threat and depressive symptoms (Lazarus & Folkman, 1984; Mak et al., 2004). Previous research also demonstrates that challenge is related to wellbeing (Adie et al., 2008) and positive emotions (Doron & Martinent, 2017), although the present study adds to that literature by highlighting that challenge is also associated with greater vitality specifically. Athletes who have higher levels of vitality consider themselves to have better levels of wellbeing (Fruchart & Rulence-Pâques, 2020), which in turn may provide athletes with feelings of an increased energised state to assist performance (Lavrushcheva, 2020).

However, it also should be noted that depressive symptoms and vitality may fluctuate thus meaning that situational factors may influence the responses by participants. Importantly, these results add weight to the notion that challenge and threat are not necessarily at opposite ends of a continuum (Uphill et al., 2019) and they highlight the importance of considering both stress appraisals when examining athlete wellbeing and illbeing as challenge and threat may associate differently with affective states (Chadha et al., 2019). Indeed, although challenge and threat may be related, they can occur simultaneously and should be considered as separate constructs (Lazarus & Folkman, 1984).

In partial support of the hypothesis, vitality was found to be significantly negatively related to depressive symptoms, but depressive symptoms were not found to significantly relate to vitality. Although the present study is cross-sectional in design, the strength of the negative correlation between vitality and depressive symptoms may indicate the importance of vitality in reducing psychological illbeing. With this in mind, it may be that practitioners could consider focusing on ways to enhance subjective vitality in athletes, such as by promoting a 'stress-is-enhancing' mindset and rational beliefs, and in turn this may result in a decrease in depressive symptoms. Future research may consider assessing the same relationships with a clinical population, such as by including individuals who have received a clinical diagnosis of depression, or by using interventions which target improvements in trait beliefs to assess changes in depression and vitality over a prolonged period of time.

As hypothesised, males reported significantly higher vitality compared to females. Females had higher irrational beliefs than males. Also supporting the hypothesis and the literature (Lee et al., 2018) males reported significantly higher challenge and lower threat than females. Contrary to the hypothesis, there were no significant differences in stress mindset or depressive symptoms, which is in contrast to the findings of Park et al. (2018) and Mak et al. (2004) respectively. However, the findings of the present study offer support for research by Nixdorf et al. (2013), who found no significant gender differences in depressive symptoms. Supporting the hypothesis, age was found to have a significant negative relationship with threat and depressive symptoms. Additionally, age had a significant negative relationship with irrational beliefs. This is supported by previous findings in the literature and may be explained by older athletes typically possessing more experience than younger athletes (e.g., Turner & Allen, 2018). In contrast to the hypothesis was the finding of a significant positive relationship between age and vitality and the significant negative relationship between age and stress mindset. There was no significant relationship between age and challenge.

As used in previous related research (e.g., Chadha et al., 2019) the use of path analysis is a strength of the present study as it accounts for multiple associations simultaneously and examines direct and indirect effects to generate a greater understanding as to how stress mindset and other irrational beliefs relate to stress appraisals and psychological wellbeing. It allows for a clear conceptualization of the theory through the format of a visual model (Byrne, 2010), although future research may wish to consider using Structural Equation Modeling with latent variables to explore a full model. Furthermore, a strength of the study is that it combines two variations of beliefs in stress mindset and other irrational beliefs into an integrated model for the first time. In a practical setting, findings of the present study suggest that promoting a 'stress-is-enhancing' mindset through techniques such as videos and training (e.g., Crum et al., 2013) will positively impact on positive psychological traits such as challenge and vitality and may influence negative psychological traits such as threat and depressive symptoms. Indeed, stress mindset has been shown to be a malleable belief that can be enhanced through brief interventions in a cost-efficient manner (e.g., Crum et al., 2013; 2017), whilst there is growing evidence to show the efficacy of REBT as an effective method to reduce irrational beliefs in athletes (e.g., Cunningham & Turner, 2016). As both stress mindset and other irrational beliefs are united by aspects of REBT theory, implementing an

REBT-based intervention may promote a 'stress-is-enhancing' mindset and rational beliefs simultaneously by challenging counterproductive beliefs (Turner, 2016) and encouraging more realistic thoughts that are in proportion to stressful events (Froggatt, 2005). Additionally, practitioners may wish to consider reappraisal of stress responses when working with athletes, emphasizing that they do not have to be defined by their initial appraisal of a stressful situation as it is possible to reappraise a situation from being a threat to a challenge (Meijen et al., 2020). A limitation of the study is that the data is cross-sectional and does not imply causation. Therefore, future research should look to alter irrational beliefs (Davis & Turner, 2020) in addition to stress mindset to ascertain whether this influences stress appraisals and subsequent psychological wellbeing in the way the model may imply. Additionally, future research should also investigate the effect of stress mindset on sport performance and whether increasing a 'stress-is-enhancing' mindset leads to improvements in sporting performance levels. Future research may also wish to consider how stress mindset and other irrational beliefs relate to challenge and threat immediately prior to a stressful event, which may mean that physiological data could also be collected.

In conclusion, the present study aimed to investigate whether athletes' stress mindset and other irrational beliefs were associated with their depressive symptoms and vitality, through stress appraisals. Using path analysis, data generally supported the model predicting depressive symptoms and vitality. In summary, results demonstrated that the relationships between stress mindset, irrational beliefs and psychological wellbeing are influenced by direct and indirect effects of challenge and threat. Put simply, an individual's beliefs relate to the likelihood of whether a challenge or threat appraisal is made, which will subsequently relate to levels of psychological wellbeing. Stress mindset was related positively to challenge and negatively to threat, while irrational beliefs tended to be more strongly associated with threat. Challenge was associated with vitality but this was the only direct significant relationship between appraisals and psychological wellbeing. However, self-depreciation appears to be a key irrational belief that directly predicts stress mindset, challenge, threat and depressive symptoms. Results highlight the importance of stress mindset and other irrational beliefs in athletes' psychological wellbeing. Moreover, results also continue to offer support for the relationships between irrational beliefs, challenge and threat that are put forward in the theoretical concepts of the TCTSA-R (Meijen et al., 2020) and path analysis by Chadha et al. (2019).

## Declaration of competing interest

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