

Young athletes' psychological adjustment and well-being: A study on the role of emotion regulation and the effects of a Slow-Paced Breathing intervention

Mestrado em Atividade Física e Saúde

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Porto, 2022

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Dissertação apresentada com vista à obtenção do grau de Mestre em Atividade Física e Saúde na Faculdade de Desporto da Universidade do Porto, ao abrigo do Decreto-Lei nº 74/2006, de 24 de março, na redação dada pelo Decreto-Lei nº 65/2018 de 16 de agosto.

The present dissertation was developed in order to achieve the master's degree in Physical Activity and Health, from Faculty of Sport, University of Porto, according to the Decree-law nº74/2006 from March 24th, in the wording given by Decree-Law No. 65/2018 of August 16th.

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Ficha de catalogação:

Cunha, M. (2022). *Young athletes' psychological adjustment and well-being: A study on the role of emotion regulation and the effect of a Slow-Paced Breathing intervention*.

Porto: M. Cunha. Dissertação para a obtenção do grau de Mestre em Atividade Física e Saúde, apresentada à Faculdade de Desporto da Universidade do Porto.

Keywords: young athletes; adolescents' well-being; psychological adjustment; emotion regulation; self-control; slow breathing.

Dedicatória

À minha família e amigos,
por fazerem parte de quem sou hoje.

Agradecimentos

Em primeiro lugar agradecer aos meus orientadores. Ao Professor Rui Sofia que supervisionou o desenvolvimento desta dissertação desde o começo, pelo tempo e disponibilidade ao longo destes últimos meses. Da mesma forma à Professora Cláudia Dias pelo acompanhamento e tempo disponibilizado. A ambos por todas as orientações e conhecimentos partilhados, mas sobretudo por me guiarem neste percurso nesta área de investigação tão pouco explorada na minha formação até ao momento. Embora não sendo orientador, uma palavra de apreço também ao Professor Nuno-Côrte-Real. Foi o meu elo de ligação à psicologia do desporto durante o mestrado e indiretamente o maior impulsionador para o desenvolvimento desta dissertação.

De seguida, agradecer a todos os atletas, treinadores e dirigentes dos vários clubes que disponibilizaram do seu tempo para me ajudaram na recolha de dados. Também à secção de voleibol do Vitória Sport Clube, particularmente aos pais e atletas das equipas de cadetes e juvenis femininas da época desportiva de 2021/2022, pela confiança ao aceitarem fazer parte deste estudo. A realização desta dissertação não seria possível sem eles.

Um enorme obrigado a toda a minha família. Aos meus pais que sempre incentivaram e criaram as melhores condições possíveis durante a minha carreira académica. Por me apoiarem e entenderem mesmo que as minhas decisões não tivessem sido as mais ortodoxas. À minha irmã que, por já ter percorrido este caminho, sempre serviu de exemplo da força de vontade e ética de trabalho necessárias que o grau de mestre acarreta. Finalmente ao meu irmão que, não por ter grande voto na matéria, partilhou toda a vida comigo e sempre foi uma fonte de suporte e motivação para todos os desafios aos quais me comprometi até ao momento.

À Patrícia, minha parceira de vida, por estares incondicionalmente do meu lado durante os momentos mais felizes e alturas de maior indecisão. Por me amares como sou, mas ao mesmo tempo não me deixares perder o foco. Por todo o suporte e preocupação quer durante a realização desta dissertação como em tudo o resto.

Agradecer também aos meus amigos. Aos que vêm de lá de trás, que apesar das reuniões não serem tão frequentes como outrora, a vossa companhia sabe sempre a casa. E dos que afortunadamente fui amealhando ao longo do caminho, quer pelo voleibol quer pela universidade. Todos contribuíram para a pessoa que sou hoje, um “muito obrigado”.

Um agradecimento especial ao voleibol, que para mim é muito mais do que um desporto. Obrigado por todos os desafios e conquistas que vivenciei por tua causa. Por todas as pessoas que conheci, amigos que ganhei, relações que nutri, sítios que conheci e momentos que experienciei. Por me teres tornado mais resiliente, trabalhador e sonhador, mas sobretudo por me teres tornado mais feliz.

Obrigado a todos que se cruzaram comigo, espero ter devolvido pelo menos uma pequena parte do que me deram a mim.

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Abstract

Currently, youth psychological health and well-being is alarming and tends to aggravate. Athletes face several unique stressors due to competition and other specificities of their lifestyle. Therefore, this dissertation aimed to explore current youth athletes' mental health and well-being. Study I focused on the role of self-control and emotion regulation on young athletes' psychological wellbeing, while also considering the influence of implicit beliefs of emotions. A sample of 155 athletes (61.3% females) ranging from the ages of 15 to 28 ($M = 16.72$, $SD = 2.44$) completed an online survey with self-report measures of psychological health and well-being markers. Study II focused on exploring slow-paced breathing (SPB) as a mental health and well-being promoting tool in young female volleyball players. A sample of 22 athletes ($M = 15.86$, $SD = .83$ years) from the same volleyball club were assigned to the experimental (EG) and control group (CG). The EG performed an 8-week protocol of 5-min SPB sessions. Pre- and post-intervention questionnaires with self-report measures, and weekly CO₂ tolerance tests (CO₂TT) were administrated. Overall, the studies suggested a possible inefficient and/or insufficient cognitive reappraisal combined with a preference towards expressive suppression. Also, that self-control's relation to cognitive well-being could be time and/or situation dependent. Moreover, reduced SPB sessions could prove insufficient to detect significative improvements in psychological health and well-being after 8 weeks of 3 weekly sessions. Although, positive qualitative reports and significative improvements in CO₂TT may imply that some effects were taking place. These results highlight the necessity of new programmes that target both psychological health and educate adolescents cognitively to better deal with stressful situations, particularly in emotional regulation strategies.

Keywords: young athletes; adolescents' well-being; psychological adjustment; emotion regulation; self-control; slow breathing.

Resumo

O estado atual da saúde mental e bem-estar dos jovens é alarmante e tem tendência a agravar-se. Os atletas lidam com vários stresses particulares ao seu estilo de vida e ao contexto competitivo. Posto isto, esta dissertação teve como objetivo explorar a estado atual da saúde mental e bem-estar em jovens desportistas. O Estudo I focou-se no papel do autocontrolo e da regulação emocional no bem-estar psicológico de jovens atletas, considerando também a influência das suas crenças implícitas acerca das emoções. Uma amostra de 155 atletas (61,3% do sexo feminino) com idades compreendidas entre os 15 e os 28 anos ($M = 16.72$, $DP = 2.44$) respondeu a um inquérito online com medidas de autorrelato de marcadores de saúde psicológica e bem-estar. O Estudo 2 focou-se em explorar a respiração lenta (SPB) como ferramenta promotora da saúde mental e bem-estar em jovens jogadoras de voleibol feminino. Uma amostra de 22 atletas ($M = 15.86$, $DP = 0.83$ anos) do mesmo clube de voleibol foram designadas para o grupo experimental (EG) e controlo (GC). O EG realizou um protocolo de 8 semanas com sessões de 5 min. Foram aplicados questionários pré e pós-intervenção com medidas de autorrelato, e realizado semanalmente o teste de tolerância ao CO₂ (CO₂TT). Os estudos sugerem uma possível reavaliação cognitiva ineficiente e/ou insuficiente combinada com uma preferência pela supressão. Além disso, a relação do autocontrolo com o bem-estar subjetivo pode ser dependente do tempo e/ou da situação. Sessões reduzidas de SPB pode ser insuficiente para detetar melhorias significativas na saúde mental e bem-estar após 8 semanas de 3 sessões semanais. No entanto, relatórios qualitativos positivos e melhorias significativas no CO₂TT podem sugerir que alguns efeitos estavam a ocorrer. Os resultados evidenciam a necessidade de novos programas que visem a saúde psicológica educando cognitivamente os adolescentes para lidarem com situações stressantes, particularmente estratégias de regulação emocional.

Palavras-chave: jovens atletas; bem-estar de adolescentes; ajuste psicológico; regulação emocional; autocontrolo; respiração lenta.

List of abbreviations

bpm – Breaths per minute
BSCS – Brief self-control scale
CG – Control group
CIb - bootstrapped 95% confidence interval
CO₂ - Carbon Dioxide
CO₂TT – CO₂ tolerance test
EG – Experimental group
ERQ-CA – Emotional regulation questionnaire for children and adolescents
HRV – Heart rate variability
IBE – Implicit beliefs about emotions
IBES – Implicit beliefs about emotions scale
IV - independent variable
M – mediator
OV - outcome variable
PANAS – Positive affect and negative affect scale
PP – Perception of performance
PSS – Perceived stress scale
SHS – Subjective happiness scale
SPB – Slow-paced breathing
STAI – State-Trait anxiety inventory
SWLS – Satisfaction with life scale
VIF - Variance Inflation Factor

General introduction

Following the recent COVID-19, pandemic mental health awareness is on an all-time high. Adolescents are no exception, even more so given the importance of this transitional period characterized by personal, academic, and social pressures. (McLaughlin & King, 2015). Girls are particularly more reactive towards stressful events, leading to increased prevalence of internalized mental disorders such as depression, anxiety, and body dysmorphia when compared to their male peers (Fox et al., 2010; Soltanmohammadlou et al., 2022). Puberty timing and possibly menstruation related hormonal fluxes may be responsible for this gender differences (Byrne et al., 2022; Owens et al., 2020).

Moreover, first symptoms of most mental disorders occur during adolescence until early-adulthood (Caspi et al., 2020). Even before the pandemic it was estimated that one in seven adolescents experienced mental disorders (UNICEF, 2021). And considering the pandemic's effects on several elements of adolescents life's, including school attendance, leisure activities, socializing and access to school based mental support, mental illness rates are set to increase substantially (Oster & Richter, 2022). Mental illness related conditions, such as mood and anxiety disorders, substance abuse, suicide ideation and /or attempt and eating disorders have been growing in recent years, some reporting unprecedented rises during the COVID-19 pandemic (Chadi et al., 2022). Moreover, reportedly these mental health conditions in adolescence have a great impact on adulthood and may contribute to higher rates of unemployment, lower academic accomplishment, decreased physical health, and feeble social and/or family relationships (Copeland et al., 2015).

Also, the relationship between sports involvement and physical and psychological health is well established. Youth sports participation is often associated with decreased levels of mental illness (e.g., depression, anxiety, substance abuse), improved overall

well-being, and academical accomplishment (Ibis & Aktug, 2018; McKay et al., 2019). However, it is often a source of additional stress. Balancing school with training regimens, while often managing high personal or external expectations from both careers, coupled with injuries, overtraining, poor sleep, stressful competitive environments can overload the athletes physical and mental state (Diamond et al., 2022; Xanthopoulos et al., 2020).

In addition to these stressors, major developments in self-control occur during adolescence due to its new or increased challenges on one's self-regulation. Exacerbated by youth sport participation and its unique set of stressors (Dolenc, 2015; Duckworth & Steinberg, 2015). Generally, self-control involves effortful regulation of the self by the self. It entails the regulation of behavioural, emotional, and attentional impulses most often in favour of long-term goals (Duckworth, 2011). Adolescents on-set self-control is related to academic and sports performance, physical and psychological health, and overall well-being (Boat & Cooper, 2019; Converse et al., 2018; Duckworth et al., 2019). Furthermore, youth's self-control may predict adult's self-control, as well as work performance, well-being, physical health, and wealth (Jo & Bouffard, 2014; Moffitt et al., 2013; Tangney et al., 2018).

Likewise, emotional regulation strategies consolidate during adolescence, along with changes in social environment and brain structure characteristic of this period (McRae et al., 2012). Emotion regulation entails the process of regulation emotional intensity over time, thus manipulating the "spontaneous flow" of emotions. Two of the most researched emotional regulation strategies are cognitive reappraisal (changing perception towards a particular event) and expressive suppression (attempting to hide any outwards emotional expression) (Cutuli, 2014). Frequent use of cognitive reappraisal has been linked with enhanced psychological well-being and reduced mental distress.

Conversely, expressive suppression use has been shown to relate inversely with the same measures (Haga et al., 2009; Koval et al., 2015; Moscovitch et al., 2013).

Adolescence appears to be a decisive period for mental health promoting interventions. With roots in different cultures and ancient practices, such as yogic mediation and *pranayama*, slow-paced breathing (SPB) entails a non-invasive and highly accessible practice which is often recommended for stress reduction and improving overall well-being (Edwards, 2008). SPB can increase vagal control, promoting a shift towards parasympathetic nervous system dominance, and may be responsible for various physiological and psychological benefits (Erkkilä et al., 2021; Laborde et al., 2021; Ma et al., 2017). As most slow breathing techniques, SPB attempts to slow breathing frequency from the usual 12-20 breaths per minute (bpm) to around 6 bpm (You et al., 2021). Experimental studies in adolescents have reported decreases in anxiety and depression, as well as improved academic achievement (Aranberri-Ruiz et al., 2022; Laborde et al., 2017; Sellakumar, 2015).

Considering all the additional stressors characteristic of organized sports participation and the lack of research focused on athletes' well-being and psychological adjustment compared to their non-athletic peers, the present dissertation, divided in two studies, aims to assess current youth athletes' mental health and well-being after the recent COVID-19 pandemic. Study I intend to explore the role of self-control and emotional regulation strategies on both psychological health, as measured by trait anxiety and perceived stress, as well as subjective and emotional well-being. Study II instead aimed to investigate the effects of a SPB program as tool for managing stress and anxiety in female youth volleyball athletes. A general discussion describing the main results of both studies and exploring the studies' limitations, as well as future directions will conclude the dissertation. This dissertation will certainly contribute to further the

understand of the repercussions of recent events in the psychological health and well-being of this segment of adolescent population, while attempting to provide tools for early on-set addressing developing mental disorders and/or managing day-to-day stress.

Study 1

**The role of implicit beliefs about emotions and emotion regulation on youth
psychological adjustment: A study among young athletes¹**

¹Study submitted for publication in the *Journal of Youth Studies*.

Abstract

Currently, youth psychological health and well-being is alarming and tends to aggravate. Besides being subjected to the same stressors as their non-athletic peers, athletes are also faced with several unique stressors due to competition and other specificities of their lifestyle. Therefore, this study aimed at understanding the role of self-control and emotion regulation on young athletes' psychological wellbeing, while also considering the influence of implicit beliefs of emotions. For this purpose, a sample of 155 athletes (61.3% females) ranging from the ages of 15 to 28 ($M = 16.72$, $SD = 2.44$) completed an online survey with self-report measures of trait anxiety, perceived stress, positive and negative affect, subjective happiness, life satisfaction, implicit beliefs about emotions, self-control, and emotion regulation. Results suggest that implicit beliefs about emotions and self-control predicted better psychological adjustment whereas expressive suppression was associated with poorer outcomes. Although incremental beliefs about emotions were positively associated with self-control and cognitive reappraisal no mediation was observed between implicit beliefs and markers of psychological adjustment. Overall, findings point out the importance of interventions directed at improving emotion regulation efficacy as key to improve adolescents' psychological health and well-being.

Keywords: young athletes; adolescents' well-being; psychological adjustment; implicit beliefs; emotion regulation; self-control

Introduction

Adolescence is a critical and formative period in which individuals begin their transition from childhood to adulthood. Currently, youth psychological health and well-being is alarming. As of 2019 it was estimated that one in seven adolescents experience mental disorders, and depression is now the leading cause of poor health and/or incapacity worldwide (UNICEF, 2021). Additionally, because of COVID-19, adolescents experience unprecedented disturbances on their day-to-day. Studies have suggested that the recent COVID-19 pandemic will be a precipitant of mental illness and, consequently, overall diminished well-being (Zolopa et al., 2022). Coupled with the fact that access to mental health counselling was limited during this period, especially for disadvantaged youth (Banks, 2021), the current situation tends to become more severe. Key stressors for youth include coping with everyday stressful events/situations, school, and house-related problems, as well as the perception of risk due to personal characteristics such as racial ethnicity, sexual identity and/or orientation, disability, and family background (Grové, 2021; Hashmi et al., 2022; Lorimy et al., 2021; Njoroge et al., 2021). Adolescents' well-being and mental health has been shown to affect adulthood, resulting in less academically accomplished individuals, with higher rates of unemployment, and poor social and family relationships (Agnafors et al., 2021; Copeland et al., 2009; Kansky et al., 2016).

Although youth sport participation is often associated with improved well-being and mental health, competition often presents a new set of circumstances, especially for elite athletes (Hosker et al., 2019). According to the literature, youth athletes are subjected to the same stressors as their non-athletic peers (e.g., anxiety, depression, substance abuse, eating disorders) (Bean et al., 2014; Whitley et al., 2021; Xanthopoulos et al., 2020), but are also faced with several unique stressors due to competition and other

specificities of their lifestyle. Nowadays, there is an accentuated result-focused approach to youth sports, most times due to the parents' unrealistic expectations or other external pressures (Mossman et al., 2021). This results in an overwhelming schedule, adding an extensive training program and a large number of competitions to an already packed school schedule, most of the time filled with extra-hours, individually or with a tutor. Subsequent, little leisure time for social activities, hobbies and, most importantly, rest, have a negative impact in the adolescent's mental health and overall well-being (Campbell et al., 2018). Additionally, competition is a highly stressful event, including aspects such as rivalry, meeting expectations, dealing with spectators and possible coaches' aggressive behaviours (Arnold & Fletcher, 2012; Driskell et al., 2014; Gustafsson et al., 2017; Nicholls et al., 2016).

Although there are several studies discussing the state of mental health in youth, there is lacking research regarding their athletic peers (Andy Smith, 2020; Vella & Swann, 2021). Due to these unique stressors, exploring youth athletes' psychological health and well-being is urgent to better understand and develop tools for a better navigation of this stressful environment at such young ages. A landscape of this population's beliefs about emotions, emotional regulation, and self-control and the way they affect psychological health, emotional well-being and cognitive well-being will be painted in this cross-sectional study.

Self-control impact in youth mental health and well-being

Adolescence is a stage of new and enhanced demands on self-regulation. More so with the additional pressures of youth sports participation (Dubuc-Charbonneau & Durand-Bush, 2015). Self-control is the ability to suppress unwanted emotions, desires, and actions in favour of more appropriate alternatives. Is often associated with postponed gratification, the ability to prioritize long-term goals in place of short-term satisfaction

and/or distractions (Duckworth & Steinberg, 2015). Individuals with high self-control have been shown to be more accomplished academically and financially, more friendly and trustworthy, psychologically healthier and physically and more capable of adapting to different environments (Allemand et al., 2019; Duckworth et al., 2019; Frieze et al., 2017; F. Yang & Jiang, 2022). On the other hand, lower self-control is related to poor behavioural outcomes, such as binge eating, substance abuse, procrastination, and worse interpersonal relationships (Pearson et al., 2018; Shea et al., 2013; To et al., 2021; C. Yang et al., 2019).

Even though it is possible to change, for most people self-control remains similar ever since developed during youth (F. Yang & Jiang, 2022). Therefore, while having an instant effect on academic and sports performance, psychological health, and well-being (Boat & Cooper, 2019; Converse et al., 2018; Duckworth et al., 2019; Ronen et al., 2016), adolescent's self-control will also somewhat predict adult's self-control (Jo & Bouffard, 2014). Studies have reported that adolescent's self-control can predict several behaviours and perceptions in adulthood, such as romantic relationships, work performance, and well-being (Allemand et al., 2019; Converse et al., 2018).

Implicit beliefs about emotions and emotion regulation impact on youth mental health and well-being

An implicit belief is one's understanding of how the world works. These views are often associated with the controllability of traits or skills (e.g., intelligence, personality, emotions, body weight) (Burnette, 2010; de Castella et al., 2013; De Castella & Byrne, 2015; Yeager et al., 2013). The belief that a certain trait is fixed (e.g., "*I never been good at maths, therefore I can't do this.*") is categorized as an entity belief. Entity theorists typically attribute their capacities to genetics (Burnette, 2010). In the opposite of the spectrum are incremental beliefs, which pertains to traits that are somewhat

controllable (e.g., “*I never been good at maths, although if I practice, I will improve.*”). Therefore, incremental theorists usually evidence effort and motivation as responsible for their performance. Incremental beliefs about emotions refers to one’s belief that emotions are controllable. These beliefs have been shown to be developed and solidified around adolescence, with reports of children as young as five to already have developed reliable beliefs about emotions (Waters & Thompson, 2014).

As stated previously, adolescence is a sensible transitional period with its own set of stressors and challenges. An entity mindset is associated with diminished well-being and psychological disorders, such as anxiety and depression. Studies have confirmed these correlations in adolescents and young adults (de Castella et al., 2013; Ford et al., 2018). Depressive symptoms in youth have been shown to possibly aggravate and subsequently have a major impact in one’s well-being in adulthood (Copeland et al., 2009). Moreover, implicit beliefs about emotions are closely associated with emotional regulation (de Castella et al., 2013; De Castella et al., 2018; Trincas et al., 2016).

Many emotional regulation strategies are identified, although the two most researched are cognitive reappraisal (i.e., changing perception towards a particular event) and expressive suppression (i.e., attempting to hide any outwards emotional expression) (Cutuli, 2014). These strategies differ in time related to the event that induced the emotional reaction. Cognitive reappraisal is considered “antecedent-focused”, which implies that it occurs before the event is fully experienced. Expressive suppression, on the other hand, occurs after the event is experienced and is considered a “response-focused” strategy (Schroder et al., 2015). The development and consolidation of emotional regulation strategies also takes part during adolescence. Studies of typically developing individuals describe a shift towards a greater use of adaptive regulatory strategies along the adolescence years (Gullone et al., 2010; Zimmermann & Iwanski,

2014). This cognitive development coincides with changes in social environment and brain structure characteristic of this age.

Also, reappraisal is commonly associated with improved well-being and psychological health (Cutuli, 2014; Kobylińska et al., 2020; Moscovitch et al., 2013). Conversely, the regular use of expressive suppression has been shown to lead to increased levels of psychological distress and consequently lower overall well-being (Haga et al., 2009; Moore et al., 2008). Nonetheless, individuals with an incremental mindset may be more prone to use the prior instead of the latter. A study by De Castella and colleagues showed that individuals who believe that emotions are controllable are more motivated to use reappraisal instead of suppression when facing a stressful situation, which contributed partly to increased levels of well-being and decreased psychological distress (De Castella et al., 2013). Regarding expressive suppression, it could be hypothesized that a more entity mindset would enhance the use of expressive suppression. However, several studies identified that suppression use is independent of one's beliefs about emotions (Kneeland et al., 2016; Schroder et al., 2015; Tamir et al., 2007).

The current study

After addressing the importance of adolescent development stage to several adulthood outcomes, the main goal of the present study was to explore youth athletes' implicit beliefs about emotions, and how they relate to emotional regulation and self-control, as well as to their psychological health, emotional and cognitive well-being. Therefore, this study will test two-way associations between emotional regulation, self-control, and implicit beliefs about emotions with several psychological and well-being markers. To further understand the impact of these variables on young athlete's life, this study will also examine how implicit beliefs about emotions, emotion regulation and self-control predict psychological and well-being related outcomes.

Additionally, the mediating role of emotional regulation strategies and self-control in the relationship between beliefs about emotions with trait anxiety, perceived stress, life satisfaction and subjective happiness was also explored. Indeed, studies have suggested that emotion regulation (King & dela Rosa, 2019), and implicit beliefs are associated with well-being/distress through the use of cognitive reappraisal (De Castella, 2013). In addition, both self-control (Converse et al., 2018) and cognitive reappraisal (Kobylińska et al., 2020) are associated with positive cognitive well-being outcomes.

Methods

Participants

A total of 168 athletes completed an online survey. Inclusion criteria included a) being 15 or older; b) residing in Portugal in the year the data was collected; c) participating in a federated sport; d) athlete's agreement and parents' or tutor's authorization after being informed about the general objectives and conditions of the study. Thirteen (7.74 %) participants were excluded due to the age restrictions. The final sample size comprised 155 athletes (61.3% females) ranging from the ages of 15 and 28 ($M = 16.72$, $SD = 2.44$), from different sports (72.2%, volleyball; 14.2%, basketball; 10.3% football; 3.2 % others), and age categories, namely under-16 ($n = 48$, 31.0%), under-17 ($n = 50$, 32.3%), under-19 ($n = 19$, 12.3%), under-21 ($n = 19$, 12.3%) and senior ($n = 18$, 11,6%). The participants' average of weekly hours of training in the year of the study was 7.42 ($SD = 2.84$) and years of practice was 6.05 years ($SD = 3.78$).

Measures

Brief Self-Control Scale. Self-Control was measured with the brief self-control scale (BSCS) developed by Tangney and colleagues (2004) and subsequently translated and validated to Portuguese by Cruz and colleagues (2013). The questionnaire consists of 13 items answered on a 5-point Likert scale ranging from 1 (*Not at all like me*) to 5 (*Very much like me*). Items such as “I refuse or reject things that are bad for me” are used to access one’s overall capacity to ignore or change one’s emotional response, as well as refrain from acting on undesirable tendencies. The total score is the sum off all the items ranging from 13 to 65. The higher the score, the higher one’s self-control. In the present sample, a reliability analysis revealed a Cronbach’s alpha of .69.

Emotional Regulation Questionnaire for Children and Adolescents. Emotional regulation was measured with the Emotional Regulation Questionnaire for Children and Adolescents (ERQ-CA) developed by Gullone and Taffe (2012) and subsequently translated and validated to Portuguese by Teixeira and colleagues (2014). The questionnaire consists of 10 items answered on a 5-point Likert scale ranging from 1 (*Totally disagree*) to 5 (*Totally agree*). Of those 10 items, six access strategies of cognitive reappraisal (e.g., “When I’m worried about something, I try to think about it in a way that helps me to feel better”). The other four items (e.g., “I keep my feelings to myself”), access strategies of expressive suppression. The scale is used to access one’s ability to, consciously or unconsciously, manage one’s emotions in socially and contextually adaptive ways. The total score for each scale is the sum of its items, ranging from 6 to 30 for reappraisal and 4 to 20 for suppression. The higher the score, the greater the use of that particular emotion regulation strategy. In the present sample, a reliability analysis revealed a Cronbach’s alpha of .72 for suppression and .66 for reappraisal.

State-Trait Anxiety Inventory. Trait anxiety was measured with the state-trait anxiety inventory for adults (STAI Form Y-2), developed by Spielberger and colleagues (1982) and subsequently translated and validated to Portuguese by Silva and Campos (1998). The questionnaire consists of 20 items answered on a 4-point Likert scale ranging from 1 (*Almost never*) to 4 (*Almost always*). Items such as “I worry too much over something that really doesn’t matter” are used to measure the overall presence of feelings of worry, discomfort, anxiety, and arousal in one’s life, regardless of time and situation. The total score is the sum of its items ranging from 20 to 80, with higher scores reflecting greater anxiety. In the present sample, a reliability analysis revealed a Cronbach’s alpha of .94.

Perceived Stress Scale. Perceived stress was measured with the Perceived Stress Scale (PSS-10) developed by Cohen and colleagues (1983) and subsequently translated and validated to Portuguese by Trigo and colleagues (2010). The questionnaire consists of 10 items answered on a 5-point Likert scale ranging from 1 (*Never*) to 5 (*Very frequently*). Items such as “In the last month, how often have you been unable to control the irritations in your life?” are used to measure the degree to which various situations in one’s day-to-day are appraised as stressful and if it exceeds one’s ability to cope with those same situations. The total score is the sum of its items, ranging from 10 to 50, with higher scores correlating with greater perceived stress. In the present sample, a reliability analysis revealed a Cronbach’s alpha of .87.

Positive Affect Negative Affect Schedule. The overall mood and emotions one’s experiencing throughout the day were measured with the positive affect and negative affect scale (PANAS) developed by Watson and colleagues (1988) and subsequently translated and validated to Portuguese by Corte-Real and colleagues (2004). The questionnaire can be used to assess affect in various temporal frames (e.g., in the past day, week, year, in general) and consists of 20 items answered on a 5-point Likert scale

ranging from 1 (*I'm nothing like that*) to 5 (*I'm always like that*). Of those items, 10 measure positive affect (e.g., proud, inspired) and 10 measure negative affect (e.g., guilty, nervous). The total score for both positive and negative affect is the sum of its items ranging from 10 to 50. In the present sample, a reliability analysis revealed a Cronbach's alpha of .80 for positive affect and .83 for negative affect.

Satisfaction with Life Scale. Global life satisfaction was measured with the Satisfaction with Life Scale (SWLS) developed by Diener and colleagues (1985) and subsequently translated and validated to Portuguese by Corte-Real and colleagues (2004). The questionnaire consists of 5 items answered on a 7-point Likert scale ranging from 1 (*Strongly disagree*) and 7 (*Strongly agree*). Items such as "If I could live my life over, I would change almost nothing" are used to access one's quality of life by his own criteria, which is a very narrow aspect of one's wellbeing. The total score is the sum of its items ranging from 5 to 35, with higher scores correlating with greater life satisfaction. In the present sample, a reliability analysis revealed a Cronbach's alpha of .86.

Implicit Beliefs about Emotions Scale. Personal beliefs about the malleability of emotions were measured with the Implicit Beliefs About Emotions Scale (IBES) developed by Tamir and colleagues (2007) and subsequently adapted to a first-person claim by De Castella and colleagues (2013). The questionnaire consists of four items answered on a 5-point Likert scale ranging from 1 (*Strongly disagree*) and 5 (*Strongly agree*). Two items, such as "If I want to, I can change the emotions that I have", measure incremental beliefs and the other two, such as "The truth is, I have very little control over my emotions", measure entity beliefs. Since both types are contrary in nature, the incremental beliefs items were reverse coded. The total score was calculated by averaging all the items, in which higher scores reflect one's more propensity to have entity belief

system and lower scores an incremental belief system. In the present sample, a reliability analysis revealed a Cronbach's alpha of .75.

Subjective Happiness Scale. A broader aspect of one's wellbeing is one's overall subjective happiness, which was measured with the Subjective Happiness Scale (SHS) developed by Lyubomirsky and Lepper (1999) and subsequently translated and validated to Portuguese by Spagnoli and colleagues (2012). The questionnaire was adapted to better fit with the overall survey structure, mainly in the phrasing of the questions, to maintain the same responses for all items. It consists of four items answered on a 7-point Likert scale ranging from 1 (*Totally disagree*) to 7 (*Totally agree*). Two items ask respondents to analyse themselves absolutely and relative to others (e.g., "In general, I consider myself a happy person."), and the other two present the respondent with a description of a happy/unhappy person and ask to which extent it relates to them (e.g., "Some people are generally not very happy. Although they are not sad, they never seem as happy as they might be. This description applies to you?"). The total score is the average of the four items, ranging from 1 to 7, with higher scores reflecting greater subjective happiness. In the present sample, a reliability analysis revealed a Cronbach's alpha of .78.

Procedures

This study was conducted accordingly with the ethical guidelines of the Helsinki declaration and its subsequent revisions. Participants were contacted and asked to participate in the study by completing an online survey with the measures described above. After agreeing to participate, athletes were asked to answer according with their own personal experiences. All participants were informed about the purpose of the research and gave verbal and written consent to participate in the study. They were also informed of the possibility of leaving the study at any point and were ensured the anonymity and confidential nature of their participation. The protocol was approved by

the Ethics committee of the Portuguese Faculty of Sports of the University of Porto (Project identification code CEFAD 10 2022).

Analytic strategy

Data was analysed using IBM SPSS Statistics 28.0. In order to investigate the study's variables bivariate relationships, Person's correlation coefficient was applied. Three levels of significance were used to group the resulting correlations ($p < .05$; $p < .01$; $p < .001$). To further understand the predictive capacity of implicit beliefs, self-control, and emotional regulation strategies, a three-stage hierarchical regression was performed. Contrary to a simple multiple regression various steps could be accounted for. The first step accounts for age and sex, the second accounts also for one's incremental beliefs about emotions which determines if one believes is possible to change oneself or not. Step 3 included both emotional regulation strategies and self-control. Before conducting the hierarchical regression analysis, a few checkmarks of importance were checked. Firstly, one multivariate outlier was removed following an examination of the *Mahalanobis* distance scores (Penny, 1996). A sample of 154 was deemed fit for an analysis which included five independent variables (Maas & Hox, 2005). Finally, collinearity statistics, tolerance, and variance inflation factor (VIF) of the predictors were all within the accepted values (Srisa-An, 2021).

Following the results of the correlations and hierarchical regression analysis, four parallel multiple mediation models were developed to further explore the mediation role of self-control and emotion regulation between implicit beliefs of emotions and the psychological and well-being markers, namely trait anxiety, perceived stress, satisfaction with life and subjective happiness. Age and gender were added to the mediation models as covariates to statistically remove their confounding effects. The multiple mediator analysis followed Preacher and Hayes (2004) approach and was conducted using the

macro they provided for SPSS. The effect of a mediator is deemed significant if the bootstrapped confident interval of the point estimate of the indirect effect through the proposed mediator does not include zero (Strobel et al., 2011). In this study, the indirect effect estimate was obtained from 5.000 bootstrap samples, and bias corrected and accelerated 95% confidence intervals were calculated.

Results

Descriptive statistics

Descriptive statistics regarding the variables of the study are presented in Table 1. Concerning trait anxiety and perceived stress total sample mean scores were 43.95 ($SD = 12.62$), and 30.64 ($SD = 6.71$), respectively. Satisfaction with life and subjective happiness showed total sample mean scores of 23.61 ($SD = 6.42$) and 4.00 ($SD = 0.80$). Also, incremental beliefs about emotions, self-control, cognitive reappraisal, and expressive suppression mean scores for the total sample were 3.31 ($SD = 0.872$), 43.61 ($SD = 6.71$), 19.70 ($SD = 3.98$) and 12.46 ($SD = 3.68$) in that order.

Table 1. *Descriptive statistics of the psychological and well-being markers.*

	Min.	Max.	M	SD	SK	K
Trait anxiety	21	74	43.95	12.62	.322	-.608
Perceived stress	14	46	30.64	6.71	-.028	-.400
PANAS						
Positive affect	19	50	36.63	5.55	-.128	.226
Negative affect	10	50	27.59	7.18	.016	.289
Satisfaction with life	5	35	23.61	6.42	-.521	-.197
Subjective happiness	2	6	4.00	.80	-.595	.550
Incremental beliefs about emotions	1	5	3.31	.87	-.146	-.317
Emotional regulation						
Cognitive reappraisal	9	30	19.70	3.98	-.098	.325
Expressive suppression	4	20	12.46	3.67	-.210	-.708
Self-control	29	58	43.61	6.71	-.102	-.617

Pearson correlations

The pattern of associations between the variables in this study are presented in Table 2. Self-control and incremental beliefs about emotions were positively correlated with positive outcomes such as positive affect, satisfaction with life, and subjective happiness. Consistently, the same two were negatively correlated with negative outcomes such as trait anxiety, perceived stress, and negative affect. As for the two strategies of emotional regulation, cognitive reappraisal showed positive correlations with positive outcomes such as positive affect and subjective happiness. Expressive suppression showed positive correlation with negative outcomes, as well as negative correlations with positive outcomes. Regarding the psychological and well-being markers, in a broader sense we could identify that trait anxiety, perceived stress and negative affect had similar profiles of correlations with the other variables in the study. The same can be said about positive affect, satisfaction with life, and subjective happiness.

Hierarchical regression

A summary of the hierarchical regression analysis is presented in Table 3. When predicting trait anxiety, both age and sex were significant predictors, $F(2,151) = 8.83$, $p < .001$, explaining 11% of the variance. In the second step, incremental beliefs about emotions were also negative predictors, increasing the variance to 41%, $F(3,150) = 35.13$, $p < .001$. Lastly, self-control was a negative predictor, whereas expressive suppression was a positive predictor, explaining a total of 56% of the variance, $F(2,151) = 31.56$, $p < .001$.

Regarding perceived stress, both age and sex were significant predictors in the first step, $F(2,151) = 6.32$, $p = .002$. However, incremental beliefs of emotions were a negative predictor in the second step, $F(3,150) = 19.88$, $p < .001$, increasing the variance to 28%,

Table 2. *Pearson Correlations for the psychological and well-being markers.*

	1	2	3	4	5	6	7	8	9	10
1. Trait anxiety	1									
2. Perceived stress	.848***	1								
PANAS										
3. Positive affect	-.422***	-.325***	1							
4. Negative affect	.750***	.641***	-.284***	1						
5. Satisfaction with life	-.614***	-.530***	.414***	-.471***	1					
6. Subjective happiness	-.712***	-.592***	.447***	-.625***	.665***	1				
7. Incremental beliefs about emotions	-.614***	-.508***	.265***	-.533***	.345***	.413***	1			
Emotional regulation										
8. Cognitive reappraisal	-.422***	-.096	.259**	-.119	.128	.128	.145	1		
9. Expressive suppression	.750***	.311***	-.200*	.235**	-.252**	-.252**	.012	.008	1	
10. Self-control	-.338***	-.233**	.273***	-.362***	.232**	.225**	.319***	-.073	-.041	1

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

In the final step, only expressive suppression was a positive predictor, explaining an overall 38% of the variance, $F(6,147) = 16.38, p < .001$.

The analysis of negative affect revealed that both age and sex were significant predictors in the first step, $F(2,151) = 5.29, p = .006$, explaining 7% of the variance. When introducing incremental beliefs of emotions, which were a positive predictor, the variance increased to 31%, $F(3,150) = 22.86$. In the third step, self-control was a negative predictor, while expressive suppression was a positive predictor, $F(5,148) = 17.05, p < .001$, increasing the variance to 41%.

Furthermore, for positive affect, neither age or sex were significant predictors, $F(2,151) = 0.30, p = .742$. However, incremental beliefs of emotion contributed positively to the model, $F(3,150) = 3.76, p = .012$, and increased the variance to 7%. Lastly, the third step revealed that self-control and cognitive reappraisal were positive predictors, whereas expressive suppression was a negative predictor, $F(6,147) = 6.50, p < .001$, raising the variance to 21%.

In terms of satisfaction with life, neither age or sex were significant predictors in the first step, $F(2,151) = 1.65, p = .196$. Nonetheless, incremental beliefs of emotion were found to be a positive predictor, $F(3,150) = 8.79, p < .001$, with a total variance of 15%. Lastly, the third step revealed that only expressive suppression was a negative predictor, $F(6,147) = 6.84, p < .001$, raising the variance to 22%.

Finally, only age was a positive predictor for subjective happiness in the first step, $F(2,151) = 4.37, p = .014$, explaining 6% of the variance. Incremental beliefs of emotions were a positive predictor in the second step, $F(3,150) = 13.11, p < .001$, and explained 21% of the variance. In the third step, both emotion regulation strategies were significant, $F(6,147) = 17.97, p < .001$, increasing the variance to 42%.

Table 3. Summary of the hierarchical regression analyses for the psychological and well-being markers.

	Trait Anxiety			Perceived Stress			Negative affect			Positive affect			Satisfaction with life			Subjective happiness		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Step 1	$(R^2 = .11; \Delta R^2 = .11^{***})$			$(R^2 = .08; \Delta R^2 = .08^{**})$			$(R^2 = .07; \Delta R^2 = .07^{**})$			$(R^2 = .00; \Delta R^2 = .00)$			$(R^2 = .02; \Delta R^2 = .02)$			$(R^2 = .06; \Delta R^2 = .06^*)$		
Age	-1,19	.40	-.23**	-.49	.22	-.18*	-.53	.23	-.19*	.10	.18	.04	.33	.21	.12	.07	.03	.22**
Sex	6,28	1.96	.25**	3.10	1.06	.23**	2.70	1.11	.19*	-.53	.90	-.05	.87	1.04	.07	-.14	.12	-.09
Step 2	$(R^2 = .41; \Delta R^2 = .31^{***})$			$(R^2 = .28; \Delta R^2 = .21^{***})$			$(R^2 = .31; \Delta R^2 = .25^{***})$			$(R^2 = .07; \Delta R^2 = .07^{**})$			$(R^2 = .15; \Delta R^2 = .13^{***})$			$(R^2 = .21; \Delta R^2 = .15^{***})$		
Incremental beliefs about emotions	-8,26	.93	-.57***	-3,62	.55	-.47***	-4,10	.56	-.51***	1,66	.51	.27**	2,71	.57	.37***	.36	.07	.40***
Step 3	$(R^2 = .56; \Delta R^2 = .15^{***})$			$(R^2 = .40; \Delta R^2 = .12^{***})$			$(R^2 = .41; \Delta R^2 = .10^{***})$			$(R^2 = .21; \Delta R^2 = .14^{***})$			$(R^2 = .22; \Delta R^2 = .07^{**})$			$(R^2 = .42; \Delta R^2 = .22^{***})$		
Self-control	-.33	.11	-.18**	-.10	.07	-.10	-.24	.07	-.24**	.20	.07	.24**	.11	.08	.11	.01	.01	.11
Cognitive reappraisal	-.11	.18	-.04	-.04	.11	-.03	-.14	.11	-.08	.36	.10	.26***	.17	.12	.11	.04	.01	.22***
Expressive suppression	1,23	.20	.36***	.61	.12	.33***	.41	.12	.22**	-.28	.11	-.19*	-.39	.13	-.22**	-.09	.01	-.41***

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

Mediation analysis

Table 4 shows the direct and indirect effects for all the parallel mediation analyses. All the models tested did not present significant total indirect effect (when considering all the mediators) in the psychological and well-being markers tested. Nevertheless, total and direct effect were significant for all variables. However, all specific indirect effects were all non-significant except for self-control, which presented a significative indirect effect on trait anxiety. This suggests that only self-control had a mediating effect on the relationship between incremental beliefs about emotions and trait anxiety. Furthermore, emotional regulation strategies and self-control combined had no mediating effect on the relationship between incremental beliefs about emotions and trait anxiety, perceived stress, subjective happiness, and satisfaction with life.

Discussion

This study aimed at exploring the role of implicit beliefs about emotions, self-control and emotion regulation on important psychological adjustment markers among youth athletes. Additionally, it also intended to analyse the potential mediating role of emotional regulation and self-control on the relationships between implicit beliefs about emotions and important markers of psychological adjustment, namely trait anxiety, perceived stress, satisfaction with life and subjective happiness.

Regarding self-control, the results of the correlation analysis reflected a significant negative association with trait anxiety, perceived stress, and negative affect. People with high self-control can inhibit or change their inner responses and avoid undesirable behaviours. The relationship between self-control and trait anxiety was already established across the literature (Englert et al., 2011). Individuals with high trait anxiety tend to show lower self-control, which in turn affects their performance and/or

Table 4. Summary of direct and indirect effects of the multiple parallel mediation.

	Direct effect	Indirect effect	95% C i _b	
			Lower	Upper
Trait anxiety (OV)	<i>F</i> (3, 150) = 35,13***; <i>R</i> ² = .41			
IBE (IV)	-7.304	-.960	-2.270	.218
Self-control (M)	-.332	-.907^	-1.725	-.3093
Cognitive Reappraisal (M)	-.112	-.071	-.500	.164
Expressive Suppression (M)	1.231	.018	-.864	1.018
Perceived Stress (OV)	<i>F</i> (3, 150) = 19,88***; <i>R</i> ² = .29			
IBE (IV)	-3.319	-.296	-.9854	.3177
Self-control (M)	-.102	-.277	-.7182	.0844
Cognitive Reappraisal (M)	-.044	-.028	-.3106	.1272
Expressive Suppression (M)	.614	.009	-.4572	.4894
Subjective Happiness (OV)	<i>F</i> (3, 150) = 13,11***; <i>R</i> ² = .42			
IBE (IV)	.297***	.060	-.0326	.1607
Self-control (M)	.013	.035	-.0053	.0811
Cognitive Reappraisal (M)	-.042***	.027	-.0057	.0839
Expressive Suppression (M)	-.087***	-.001	-.0664	.0622
Satisfaction with life (OV)	<i>F</i> (3, 150) = 8,79***; <i>R</i> ² = .39			
IBE (IV)	2.318***	.395	-.1737	1.0346
Self-control (M)	.107	.292	-.0649	.7185
Cognitive Reappraisal (M)	.170	.108	-.0564	.4486
Expressive Suppression (M)	-.125**	-.006	-.3469	.2977

Note. IV = independent variable; M = mediator; OV = outcome variable.; CI_b = bootstrapped 95% confidence interval. Direct effects, *** $p < .001$; ** $p < .01$; * $p < .05$. Indirect effects, [^]Confident interval excludes zero.

ability to accomplish a short- or long-term goal (Zhang et al., 2022). Self-control's correlation with perceived stress is also consistent with the literature (Converse et al., 2018; Duckworth et al., 2013). In line with the strength model of self-control, stress has an undermining effect on self-control given that adjusting to stressful situations is believed to consume self-control resources (Muraven & Baumeister, 2000). Through a similar mechanism of action, negative affect also consumes self-control resources (Heatherton & Wagner, 2011). The correlation analysis results also identified significant positive association of self-control with positive affect, satisfaction with life, and

subjective happiness. Indeed, positive affect acts in the opposite way of negative affect by increasing the self-control reserves, contributing to less impulsive and more controlled individual (Shmueli & Prochaska, 2012). Moreover, self-control is often associated with postponing happiness for long-term goals, which could be counterintuitive given that the positive association with satisfaction with life and subjective happiness. However, this association is well supported by the literature (Allemand et al., 2019; Converse et al., 2018). A better goal-directed behaviour and/or a competent inhibition of short-term temptations could explain this phenomenon (De Ridder & Gillebaart, 2017; Hofmann et al., 2014). Concerning the emotional regulation strategies, particularly cognitive reappraisal, the results of the correlation analysis identified only significant correlations with positive affect and subjective happiness, both positive. Contrary to expected, the correlation with trait anxiety, although negative, was not significant. Cognitive reappraisal is recognized as an efficient strategy to manage negative emotions, which are linked to anxiety (Dennis, 2007; Moscovitch et al., 2013). In the same way, it would be expected that, when adopting this emotional regulation strategy, individuals would look at stressful events from different perspectives, thus better managing negative emotions. However, even though cognitive reappraisal is generally described as an effective measure of coping with stress (Smith et al., 2019; Xu et al., 2020), a significant correlation with perceived stress was not found in the present study. A similar non-significance was identified by Schulte-Frankenfeld and Trautwein (2022) in university students. Furthermore, the use of cognitive reappraisal in everyday life is highly related to greater experience and expression of positive emotions and lesser experience and expression of negative emotions (Cutuli, 2014; Gross & John, 2003), which partly contradicts the results of the current study. The link with positive affect is concurrent with literature (Andreotti et al., 2013; Boden et al., 2012). Concerning satisfaction with life and

subjective happiness, the consensus in the literature is that cognitive reappraisal is highly linked with enhanced well-being (Haga et al., 2009; Kobylińska et al., 2020; Sha et al., 2022). Results of the current study are concurrent with literature for subjective happiness, although with satisfaction with life the correlation was non-significant. Regarding expressive suppression, the associations profile appears consistent with literature. Significant positive correlations were identified with trait anxiety, perceived stress, and negative affect. As for significant negative correlations they were found with positive affect, satisfaction with life and subjective happiness. Individuals who regularly indulge in expressive suppression are more likely to experience anxiety and depressive symptoms and consequently lower levels of well-being (Campbell-Sills et al., 2006; Moore et al., 2008).

Concerning the incremental beliefs about emotions, individuals with entity beliefs about emotions have been shown to have poorer psychological health and well-being than their peers (e.g., Ford et al., 2018; Kivity & Huppert, 2016). The results of the correlation analysis in the present study are concurrent with the literature, except for the link with emotional regulation. In fact, since individuals with incremental beliefs about emotions have been shown to be more likely to use emotional regulation strategies, particularly antecedent-focused, such as cognitive reappraisal (King & dela Rosa, 2019; Tamir et al., 2007; Vuillier et al., 2021), a significant positive correlation between cognitive reappraisal and incremental beliefs was expected. On the other hand, we anticipated the weak correlation between incremental beliefs and expressive suppression, confirming that belief that emotions controllable effect on response-focused regulation strategies may be residual. Schroder and colleagues (2015) reported a significant positive correlation between incremental beliefs about emotions and reappraisal, as well as a non-significative association with expressive suppression in college students.

An overview of the hierarchical regression analysis results suggests that, for the most part, incremental beliefs about emotions, self-control, cognitive reappraisal and expressive suppression were all capable of predicting different psychological health and well-being markers. However, beliefs about emotions alone predicted better negative outcomes such as trait anxiety, perceived stress, and negative affect. Implicit beliefs about emotions are highly linked with several psychological and well-being markers. Believing that emotions are uncontrollable is highly associated with more negative outcomes such as anxiety and depressive symptoms, stress perception, and overall poor social and personal well-being and in turn less associated with positive outcomes such as positive affect, inter-personal relationships, satisfaction with life and subjective happiness (de Castella et al., 2013; Ford et al., 2018; Kappes & Schikowski, 2013; Kivity & Huppert, 2016).

On the other hand, although a malleable mindset towards emotions appears to be essential for a better overall well-being, considering that, in the present study, positive outcomes were better or at least similarly predicted when accounting for emotional regulation strategies and self-control, it seems not to be sufficient to believe that emotions are somewhat controllable without self-regulating them to see improvements on well-being. A study by De Castella and colleagues (2014) found similar results in subjects with social anxiety. After controlling for social anxiety, personal beliefs about emotions successfully predicted stress, trait anxiety, and negative affect, but were not a significant predictor of life satisfaction or positive affect.

Moreover, inefficient and/or insufficient use of cognitive reappraisal could explain results of both the hierarchical regression and correlation analysis, namely the lack of significative predictive capacity of trait anxiety, perceived stress, negative affect, and satisfaction with life. Consistently, an intervention by Kivity and Huppert (2016),

showed that individuals with high social anxiety rated themselves as less capable of using cognitive reappraisal than individuals with lower social anxiety. Also, O'Toole and colleagues (2014) found that, when cognitive reappraisal was used, there was a smaller increase in positive emotions in more anxious individuals compared to their less anxious peers. In addition, although Dryman and Heimberg (2018) reported a similar use of cognitive reappraisal in individuals with high and low anxiety, they stated that an inefficient use of this emotional regulation strategy could negatively impact individual's motivation and/or confidence to resort to it in stressful events/situations. Overall, findings in the aforementioned studies may help explain the non-significant results found in our study. Furthermore, other studies have also reported non-significant association between cognitive reappraisal and negative affect (Brans et al., 2013; Brockman et al., 2017), supporting the significant variation in the relationship between daily reappraisal and negative affect across people. In some cases, reappraisal was associated with benefits to emotional well-being, whilst in other individuals could have a problematic relationship with emotional well-being. This finding could mean that while cognitive reappraisal could not help regulate strong negative emotions once they were experienced, it might help acknowledging rewarding experiences, and consequently maintaining the manifestation of positive affect throughout the day (Brockman et al., 2017).

Concerning satisfaction with life, the consensus in literature is that cognitive reappraisal is highly linked with enhanced cognitive well-being (Haga et al., 2009; Kobylińska et al., 2020; Sha et al., 2022). Nonetheless, our results showed that reappraisal was deemed a non-significative predictor of satisfaction with life. This could be due to an overall lack of effectiveness of this emotional regulation strategy, or because many factors contribute to satisfaction with life. A study by Esmaeilinasab and colleagues (2016) identified that only 14 percent of satisfaction with life was predicted by emotional

regulation strategies in university students. Moreover, most of the participants in the present study were adolescents, and although they assumed they used reappraisal as much as adults, it has been shown that they use it less, and less successfully, namely during emotionally charged situations (Dukes et al., 2022). Contextual demands and the difficulty of applying the necessary cognitive skills may limit their reliance and execution of this emotional regulation strategy (McRae et al., 2012). Nevertheless, former studies have reported no age-related differences in children and adolescents, so this is still up for debate (Gullone & Taffe, 2012).

In any case, these findings highlight the possible difficulties of reappraisal efficiency and a possible preference towards suppression in this population. In effect, concurrent with literature, expressive suppression significantly predicted psychological distress and poorer well-being (Campbell-Sills et al., 2006; Haga et al., 2009; Kalokerinos et al., 2015). A higher impact of expressive suppression on well-being was also identified by Verzeletti and colleagues (2016) in Italian adolescents. It should be noted that although the use of expressive suppression when facing stressful events could provide short-term relief, when customary, leads to increased levels of anxiety and, consequently, lower psychological well-being (Moore et al., 2008). Using it to manage negative emotions, such as sadness, anger, or anxiety, has been shown to enhance the intensity of negative affect (Gross & John, 2003; Kalokerinos et al., 2015), whereas using it to manage positive emotions, such as excitement, happiness, or confidence, has been shown to dampen the experience of positive affect (Brewer et al., 2016; Hu et al., 2014). Consequently, diminished well-being has been associated with regular use of expressive suppression, therefore negatively predicting both satisfaction with life and subjective happiness (Haga et al., 2009). Nevertheless, this relationship has been shown to be culture dependent, especially in Chinese and Hong-Kong Chinese cultures, in which suppressive expression

appears to have no effect in life satisfaction (Soto et al., 2011; Su et al., 2015). Along the same lines, overall findings support arguments that emotion regulation effectiveness is dependent on person and context (Aldao, 2013; Brockman et al., 2017).

Furthermore, self-control, which is developed early in childhood and expanded during adolescence (Ronen et al., 2016), is often associated with elevated experience of positive emotions, as the capacity to accomplish goals amplifies, which leads to better overall well-being (Hofmann et al., 2014; Li et al., 2021). Self-control is also associated with less negative emotions, anxiety, depression, and stress in one's day-to-day (Galla & Wood, 2015; Liu et al., 2020; Zhang et al., 2022). In spite of these results, in the current study, self-control was not a significant predictor of either satisfaction with life or subjective happiness, even though it predicted higher positive affect, and lower negative affect and anxiety. Recent studies identified self-control as a significant predictor of well-being in athletic and non-athletic adolescents and/or young adults (Potoczny et al., 2022; Ronen et al., 2016; Zheng et al., 2019).

It may be that self-control improves well-being by controlling one's emotions to minimize bad feelings and/or by prioritizing long-term goals in place of short-term satisfaction (Hofmann et al., 2014). Accordingly, some authors have discussed the idea that higher self-control may be "too much of a good thing" (Pierce & Aguinis, 2013), and may have its trade-offs (Wiese et al., 2017). Indeed, overregulated behaviour can affect social relationships (Letzring et al., 2005) and may not allow individuals to enjoy the benefits it can provide leading to lower well-being (Wiese et al., 2017). However, through a series of studies, Wiese and colleagues (2017) concluded that greater levels of self-control are associated with happiness. Additionally, situational differences may also explain differences in goal-oriented behaviour (Bagala, 2021). Some situational and external factors may be related to state self-control that, contrary to trait self-control,

which is an inherent personality trait, refers to the self-control available to the individual situationally (Bertrams et al., 2013). Fluctuations across time and context could be responsible for a lack of prediction of life satisfaction and happiness.

Results from the parallel mediation models showed that despite not significant by the bootstrapping method, individuals with a more malleable mindset about emotions are more prone to use reappraisal instead of suppression. This idea is in line with prior research in implicit theory of emotion, which suggests that individual's beliefs influence strategy selection for emotional regulation (Ford et al., 2018; Vuillier et al., 2021). Further investigation must be conducted in order to confirm that the non-significant indirect effect of cognitive reappraisal is caused by the previously hypothesised inefficient use of this strategy. Also, increases in self-control due to an incremental mindset towards emotions do not present a significant effect on satisfaction with life or subjective happiness. Again, this finding serves to add to the hypotheses that there either self-control negatively affects social relationships and consequently cognitive well-being and/or state self-control time and/or context-related fluctuation could diminish the importance of self-control towards a better subjective well-being in this population.

Conclusions and further directions

The present study contributed to the research field of youth psychological health and well-being in a post-covid scenario, focusing especially on the youth athlete population, and considering their own set of unique constraints and stressors. It also tackled two subjects hardly researched on this population, namely implicit beliefs about emotions and emotional regulation strategies. Novel findings from this study identified a possible lack of efficacy of cognitive reappraisal use combined with a preference of expressive suppression as a regulatory strategy. Both inefficient use of reappraisal and

regular use of suppression could be heightening anxiety, and consequently lessening emotional and cognitive well-being.

Also, cognitive well-being relationship with self-control could be time and/or situation dependent. Significant positive effects on satisfaction with life and happiness may occur later in life. Nonetheless, given the importance of interpersonal relationships for adolescents' well-being (Gómez-López et al., 2019), excessive acts of self-control may not lead to positive outcomes, which can partially explain why self-control did not predict these psychological markers.

Finally, the present study supports the necessity of promoting emotional regulation efficacy in adolescents. Research has shown that adaptive emotional regulation strategies can be taught in a group setting (Morrish et al., 2018). Positive results have been reported in several school-based interventions, centred around either mindfulness, music, slow-paced breathing, and emotional regulation training (Broderick & Jennings, 2012; Dingle et al., 2016; Houck et al., 2016; Metz et al., 2013). The propagation of similar educational programs for adolescents is critical, in order to promote their current psychological health and well-being as well as their future's.

In future investigations, the application of other methods such as a daily diaries or an experience sampling method would be useful to confirm or refute findings in this study. In fact, despite its strengths, all the measures were self-reported by an online survey and there might be biases due to common method variance (Reio, 2010). Additionally, considering that a cross-sectional design cannot answer questions about temporal precedence – especially in adolescence, where developments in beliefs about emotions and/or emotional regulation could be taking place, future studies should further explore the relationship between self-control, emotional regulation, and implicit beliefs about emotions with psychological health and well-being in youth athletes using experimental

and/or longitudinal designs. Future studies should also focus on examining different intervention approaches, such as cognitive behaviour therapy, mindfulness interventions, and slow-paced breathing and their effect on adolescents' psychological adjustment. (e.g., Frode Moen et al., 2015; Olmedilla et al., 2019; Paul & Garg, 2012). Also, bearing in mind that the present study only considered trait measures, both state and trait measures should be addressed in future research in order to get a more reliable representation of adolescents' mental health and well-being.

Lastly, due to a relatively small sample size, this study may not be representative of the complete youth sports environment in Portugal. Additionally, the sample had a bias towards team sport athletes, which have been shown to have different psychological health and well-being profiles than their individual sports counterparts (Pluhar et al., 2019). Finally, due to volleyball being one of the most prevalent sports in this sample, the participants' gender did not reflect the 72.1% of Portuguese male federated athletes as of 2019 (IPDJ/ME; PORDATA, 2021). Differences between genders have been reported in both emotional regulation and self-control (e.g., Wang et al., 2017; Zimmermann & Iwanski, 2014). Further studies should examine a larger sample that better reflects Portuguese youth sport. Also, a similar cross-sectional study in the normal population could be opportune in order to verify if these findings, especially regarding cognitive reappraisal and self-control, are generational or characterize all young athletes.

Study 2

**Effects of a Slow-Paced Breathing (SPB) intervention on young athletes’
psychological adjustment: A study with female volleyball players²**

²Study in preparation for publication in the *Journal of Physical Education and Sports*.

Abstract

Adolescence is a transitional period characterized by personal, academic, and social pressures. Girls, in particular, are more reactive towards stressful events leading to further increased prevalence of internalized mental disorders. Therefore, the present study aimed to explore slow-paced breathing as a mental health and well-being promoting tool in young female volleyball players, while considering its feasibility in an organized sports setting. Twenty-two athletes ranging in age from 15 to 17 years ($M = 15.86$, $SD = .83$), from the under-16 and under-17 teams from the same volleyball club were assigned to the experimental (EG) and control group (CG). The EG ($n = 10$) performed an 8-week 5-min slow guided-paced breathing protocol, whereas the CG ($n = 12$) followed an extended warm-up routine conducted by a coach while the breathing session was taking place. Pre- and post-intervention questionnaires with self-report measures of trait anxiety, perceived stress, positive and negative affect, subjective happiness, life satisfaction and perceived performance were administrated, coupled with weekly measurements of CO₂ tolerance test. Results suggested that, except for positive affect, all psychological and well-being markers shown no significative differences when compared to the control group after the intervention, as well as when comparing pre- and post-intervention periods within the EG. Nevertheless, overwhelmingly positive qualitative reports and significative improvements in CO₂ tolerance may imply that. In relation with the short session duration and/or intervention length, some effects of the slow-paced breathing intervention were taking place. Future studies should further explore simple and accessible interventions such as this to address on-set developing mental disorders and/or daily stress in a sports setting.

Keywords: young athletes; adolescents' well-being; female sports; mental health; slow breathing; anxiety management;

Introduction

Mental health is more than the absence of mental illness and/or its symptoms. It is essential for overall well-being, ability to face stress, everyday resilience, social and community involvement, as well as society's economic development (Palha & Palha, 2016). Adolescence is a particularly stressful transitional period characterized by underlining personal, academic, and social pressures which enhance the potential for onset mental disorders (Acharya et al., 2018). In most cases, mental disorders first occur between adolescence and early-adulthood (Caspi et al., 2020) and account for nearly half of the burden of disease between the ages of 10 through 24 years (Mei et al., 2020). Mental health concerns such as depression (Acharya et al., 2018), anxiety disorders (Strawn et al., 2021), suicide (Grasdalsmoen et al., 2020), substance abuse (Richert et al., 2020), and eating disorders (Herpertz-Dahlmann, 2015) have increased significantly among adolescents in recent years. Moreover, the aforementioned mental health concerns have been shown to severely affect adolescents' overall well-being, happiness, inter-personal relationships, and physical health, as well as to enhance the risk of aggravation, or at least persistence, of mental health disorders in adulthood (Arslan, 2021; Caspi et al., 2020). Along these lines, early onset prevention and/or treatment appears to be of the utmost importance, especially for adolescent girls. Compared to their male peers, females experience considerably higher levels of depression and anxiety (Rosenfield & Mouzon, 2012), and adolescence appears to be the turning point. Puberty timing and possibly menstruation related hormonal fluxes may be responsible for this gender differences (Byrne et al., 2022; Owens et al., 2020).

Furthermore, physical activity and sport participation could have a positive impact in adolescents' mental health (Wilson et al., 2022). Halliday and colleagues (2019) hypothesized that differences in sport and physical activity engagement could explain

mental health gender differences in adolescents. Organized sports present specific additional stressors, including overtraining, perfectionism, overloaded schedule, performance anxiety, and the competitive environment (Campbell et al., 2018; Diamond et al., 2022; Gustafsson et al., 2017), in addition to the stressors that their non-athletic peers experience (Xanthopoulos et al., 2020). Due to these unique conditions, finding tools to address mental health and well-being early in youth female athletes is essential to avoid both onset and future concerns.

Slow-paced breathing (SPB) entails a non-invasive and highly accessible practice, which is often recommended for stress reduction and improving overall well-being. Its origins come from different cultures and traditional practises, such as pranayama and meditation (Edwards, 2008), and is often incorporated with cognitive behavioural and mindfulness-based therapies (Brenner et al., 2020; Newman et al., 2020). Most breathing techniques aim to slow the breathing rate to around 6 breaths per minute (bpm), as spontaneous breathing rates hover around 12-20 bpm (Borges et al., 2021). Considering its mechanism of action, although not entirely understood, SPB is suggested to elicit a sympathetic to parasympathetic nervous system shift via vagus nerve activation (Gerritsen & Band, 2018).

Recent research in this field has shown positive effects on both psychological (e.g., stress, anxiety, depression) (Erkkilä et al., 2021; Jerath et al., 2015; Ma et al., 2017) and physiological health (e.g., HRV, cardiac vagal activity, blood pressure) (Laborde et al., 2021). In youth, it has been shown to significantly reduce state and trait anxiety and other mood disturbances, including depression (e.g., Aranberri-Ruiz et al., 2022; Busch et al., 2012; Kannaiah Sellakumar, 2015; Laborde et al., 2017). Particularly in athletes, youth or otherwise, similar interventions suggested that slow breathing rate could improve stress management (Hunt et al., 2018), emotional well-being (Borges et al.,

2021), sleep quality (Laborde et al., 2019), academic achievement (Firth-Clark et al., 2019) and decreases in pre-test and overall trait anxiety (Deschodt-Arsac et al., 2018; Dziembowska et al., 2016).

The present study aimed to explore SPB as tool for improving various psychological and well-being markers in young volleyball players. Feasibility and participant's adherence to the intervention also present major goals considering the acknowledged time constraints in organized sports. As an additional goal we also intended to explore the participants' beliefs about the impact of psychology in athletes' daily life and/or sporting career.

Material and methods

Participants

Twenty-six female volleyball players were recruited to take part in the present study. However due to inability to complete the intervention for personal reasons, four participants (15.38%) were excluded. The final sample included 22 athletes ranging in age from 15 to 17 years ($M = 15.86$, $SD = .83$). Participants' average of weekly practice hours in the present year was 7.00 ($SD = 1.35$) and the average years of practice was 5.95 years ($SD = 2.89$). Only one participant (4.50%) had previous experience with sports psychologist.

Measures

To assess the efficacy of the breathing protocol, psychological measures in the form of questionnaires and a physiological measure in the form of a stress tolerance test were applied. The questionnaires were employed at baseline and follow-up to compare participants' overall psychological health and well-being pre- and post-intervention,

whereas the stress tolerance test was conducted weekly to assess the progression during the intervention period.

Self-report measures

Psychological measures addressed psychological health in the form of trait anxiety and perceived stress and were measured by the State-Trait Anxiety Inventory (STAI Form Y-2) and the Perceived Stress Scale (PSS-10), respectively. The STAI Form Y-2 was first developed by Spielberger et al. (1982) and validated for the Portuguese population by Silva and Campos (1998). It comprises 20 items answered on a 4-point Likert scale ranging from 1 (*Almost never*) to 4 (*Almost always*). Scores range from 20 to 80, with higher scores indicating greater levels of anxiety. The PSS-10 was first developed by Cohen et al. (1983) and validated to Portuguese by Trigo et al. (2010). It comprises 10 items answered on a 5-point Likert scale ranging from 1 (*Never*) to 5 (*Very frequently*). Scores range from 10 to 50, with higher scores representing greater levels of perceived stress.

Emotional and cognitive well-being were also assessed using the Positive and Negative Affect Schedule (PANAS), the Satisfaction with Life Scale (SWLS) and the Subjective Happiness Scale (SHS). The PANAS was first developed by Watson et al. (1988) and validated to Portuguese by Corte-Real and colleagues (2004). It comprises 20 items answered on a 5-point Likert scale ranging from 1 (*I'm nothing like that*) to 5 (*I'm always like that*). The first 10 items quantify positive affect (e.g., active, strong) and the rest negative affect (e.g., aggressive, shy). The SWLS was first developed by Diener et al. (1985) and validated to Portuguese by Corte-Real et al. (2004). The questionnaire consists of 5 items answered on a 7-point Likert scale ranging from 1 (*strongly disagree*) and 7 (*Strongly agree*). Scores range from 5 to 35. SHS was first developed by Lyubomirsky and Lepper (1999) and validated to Portuguese by Spagnoli et al. (2012). It

comprises four items answered on a 7-point Likert scale ranging from 1 (*Totally disagree*) to 7 (*Totally agree*). Score ranges from 1 to 7. Higher scores in both SWLS and SH reflect greater cognitive well-being. In addition, a perceived performance (PP) item developed by Arnold et al. (2018), answered on a 10-point scale, was implemented to assess subjective sports performance.

In order to understand the participants' opinion and past experiences with psychological interventions, as well as their beliefs about the impact of psychology on athletes' daily life and/or sporting career before the intervention, four additional items were included in the pre-intervention questionnaire for both groups. Three items (e.g., "Do you think psychological factors can have a determinant role in athletes' life satisfaction and quality?") were answered on a 7-point Likert scale ranging from 1 (*Not important*) to 7 (*Totally important*). These items were followed by a non-obligatory open answer item "Generally, what is your opinion about sports' psychology interventions?".

In the EG's post-intervention questionnaire an additional set of seven items was added to assess overall perceptions and attitudes towards the intervention, as well as its feasibility, and peer recommendation. Items such as "I've noted positive changes resulting from the intervention." and "The protocol was useful and easy to apply on a daily basis." were answered on a 4-point Likert scale ranging from 1 (*Strongly disagree*) to 4 (*Strongly agree*). Similarly, these items were followed by a non-obligatory open answered item "What did you think about this intervention, did it impact your day-to-day? How?".

Physiological measures

Physiological measures were used to assess psychological health in the form of stress tolerance, specifically tolerance to endogenous CO₂. The relationship between endogenous CO₂, and tolerance to both stress and anxiety is identified in the literature

(Bandelow et al., 2017; Battaglia et al., 2014; Davies & Craske, 2014; Rappaport et al., 2017). Emotional distress and anxiety often elicit hyperventilation, which in turn results in respiratory alkalosis, as shown by a decrease of CO₂ concentration at the end of the exhale portion of the breath (Henje Blom et al., 2014). Thus, a similar measure, as applied by Bentley et al. (2020, 2022) in the form of a CO₂ tolerance test (CO₂TT), was used. Simply, the CO₂TT involves a timed maximal-duration expiration, in which higher scores, measured in seconds, are associated with greater levels of physiological stress tolerance. Participants were first introduced to the test prior to the intervention, to control for possible improvements associated with test learning.

Procedures

Ethical procedures

Written consent for the participation in the study was signed by all twenty-two athletes and one of their respective parents or guardian/s. The study was conducted following the Declaration of Helsinki, and the protocol was approved by the Ethics committee of the Portuguese Faculty of Sports of the University of Porto (Project identification code CEFAD 10 2022).

Study design

The present study was carried out using a quasi-experimental non-equivalent group design. Under-16 and Under-17 teams from the same volleyball club were assigned to the experimental (EG) and control group (CG), in that order. EG ($n = 10$) performed an 8-week slow guided-paced diaphragmatic breathing protocol, whereas CG ($n = 12$) followed an extended warm-up routine conducted by a coach while the SPB session was taking place.

The intervention followed the guidelines developed by Cruz and Viana (1996) for new sports skill acquisition and is synthesized in figure 1. Prior to the intervention, in the education phase, a session was conducted by the main researcher with the EG, addressing the concepts of psychological health, anxiety and well-being, as well as introducing guided slow breathing as a stress managing tool and providing real life examples of these techniques. A pre-intervention questionnaire was applied in both groups during this period.

During the 8-week intervention period, the EG performed a group 5-min breathing session three times per week at the beginning of practice, in order to avoid their urge to leave and possible mental and/or physical fatigue. After the second weekly session, a physiological state measure of stress tolerance was applied in the form of a CO₂ tolerance test, which had been first tested during the educational phase.

Post-intervention questionnaires were applied in the one-week follow-up period. Both pre- and post-intervention questionnaires were applied in the presence of the researcher during a team's practice session. Participants were only aware of their assigned protocol, despite their natural interaction may have led to the unblinding of the groups' assignments.

Intervention program

This slow guided breathing protocol was based on two similar interventions conducted on a high school setting by Bentley et al. (2020, 2022). The adaptation to a youth sports scenario was, for the most part, seamless, but the initial ideas of weekly applying a psychological measure in the form of a STAI-state, and presenting educational videos, were abandoned for practical reasons.

Figure 1. *Summary of the 8-week SPB intervention plan.*

Education phase

Week 0

Education group session:

- Introduction of the anxiety and well-being concepts;
- Introduction to guided slow breathing, overview of the scientific support and action mechanism;
- Possible day-to-day applications;

Pilot CO₂TT.
Pre-intervention questionnaire.

Training phase

Week 1

3x training sessions with implementation of the guided SPB protocol (duration of 7 min):

- Introduction to and practice of diaphragmatic breathing;
- Postural corrections and overall process optimization.

1st CO₂TT.

Intervention Phase

Weeks 2-4

3x training sessions with implementation of the guided SPB protocol (duration of 7 min):

- Proceeding with technical and postural corrections;
- Encouraging the use of this technique outside the sessions;

1x weekly CO₂TT.

Weeks 5-8

3x training sessions with implementation of the guided SPB protocol (duration of 7 min):

- Proceeding with technical and postural correction;
- Continue encouraging the use of this technique outside the session;
- Introduction of a stressful scenario before every session;

1x weekly CO₂TT.

Post-Intervention

Week 9

Post-intervention Questionnaire.

Protocol

The intervention consisted of a 5-minute slow guided-pace nasal breathing exercise. Different time length protocols have shown positive results in anxiety, depression, and well-being in both adult and adolescent population (e.g., Kenttä et al., 2019; Zaccaro et al., 2018). A 5-minute protocol was chosen due to usual time constraints in a sports practice setting. Even though coaches often acknowledge the importance of the psychological dimension of sports, training regimens do not reflect it (Barker & Winter, 2014; Zakrajsek et al., 2013). A short session duration could be more appealing, considering it does not “steal” much time from other practice components.

Moreover, the main characteristics of the protocol were a 6-bpm frequency, an inspiration-expiration rate of 4:6, and being strictly nasal diaphragmatic breathing. Lower breathing frequencies, particularly 6-bpm, are recognized as the benchmark in heart rate variability (HRV) training (Sevoz-Couche & Laborde, 2022), and thus its benefits on psychological health and well-being are well documented (e.g., Mather & Thayer, 2018; Schwerdtfeger et al., 2020).

Additionally, another common characteristic of multiple breathing techniques, included in HRV training, yogic breathing, and meditation, is a prolonged expiration (Campanelli et al., 2020; Komori, 2018; Pragya et al., 2014). By further enhancing vagal tone, promoting the shift to a parasympathetic state, prolonged expiration has been shown to promote relaxation, diminish anxiety, and improve overall well-being (Divya et al., 2021; Komori, 2018; Ovadia-Blechman et al., 2022).

Lastly, diaphragmatic breathing is synonymous with most breathing techniques. It involves contraction of the diaphragm, expansion of the stomach and accentuation of inspiration and expiration, automatically decreasing breathing frequency and maximizing blood gases concentration (Ma et al., 2017). Furthermore, most slow breathing techniques

are performed via nasal respiration and nasal stimulation. In animal models, nasal breathing has been shown to regulate brain and autonomic system activity via receptors in the superior nasal meatus, which in turn may influence psychological and/or behavioural outputs (Zaccaro et al., 2018).

Session example

A usual session occurred in the beginning of practice, prior to the team's warm-up, in the athletes' changing room. It begun with a breathing warm-up, consisting of three self-regulated slow breath cycles, and followed by the paced 6 bpm breathing exercise for 5 minutes. The SPB exercise was guided by the team's coach, also investigator of the study, who had experience in similar breathing practices. Instructions to "inhale" and "exhale" were stated while the athletes were in a seated position with closed eyes and hands on their stomach to get feedback on their diaphragmatic breathing. At the intervention's midpoint period, stressful scenarios were described while the group performed the breathing warm-up. The scenarios fell in three categories: school related (e.g., "I will do a presentation alone in front of the class"); volleyball related (e.g., "First time a relative/friend comes to a game and has high expectations."); social life related (e.g., "I find myself alone with a group of unknown people").

Statistical analysis

Data was analysed using IBM SPSS statistics 28.0 and GraphPad Prism 9.4.1. Nonparametric tests were applied due to a negative preliminary normality assessment. Comparison between groups at pre- and post-intervention was carried out with Mann-Whitney test. Wilcoxon sign ranked test was performed to identify differences between pre- and post-intervention in the EG. Lastly, for pairwise weekly comparison of the CO₂TT scores, a Friedman test with post-hoc Dunn's test was conducted. Open-ended questions were analysed qualitatively through content analysis (Vaismoradi et al., 2013).

Following a deductive approach, a coding protocol was firstly developed. Intuitively, new categories were included over the course of the data analysis when emerged on participant's reports.

Results

Importance of sports psychology to athletes

Prior to the intervention, most participants regarded the role of psychology in sports as mostly important. About 80-90% of the participants deemed it highly important for athlete's psychological skills ($M = 6.41$, $SD = .67$) and quality of life ($M = 6.36$, $SD = .79$). Concerning sports performance ($M = 5.23$, $SD = 1.31$), although 95% ($n = 21$) acknowledged it as important, only 45% ($n = 10$) of the participants deemed it close or totally important.

Generally, participants recognized the importance of psychology in athlete's sport careers, but also in their personal lives. Themes such as confidence ($n = 3$), time-management ($n = 1$), focus ($n = 1$), personal growth ($n = 4$), in-game self-control ($n = 2$), and overall health ($n = 2$) were addressed. As explained by one participant:

"They [psychologists] help improve the athlete's sports performance, as psychology and mental health are very important factors in one's life for athletes it's even more valuable. If an athlete is mentally unstable, no matter their capabilities, their performance will never be excellent (...) mental health and sports performance are closely related."

Intervention effect on psychological health and well-being markers

Preliminary statistical analysis found no significative differences between the CG and EG before the intervention. Intervention's effect was measured by a mixed model comprehending a Wilcoxon signed ranked test to detect differences between the pre- and post-intervention measures in the EG, and a post-intervention comparison between

experimental and CG's measures performed via Mann-Whitney test, represented on tables 5 and 6 respectively. Regarding the Wilcoxon test, no significant differences were found between the two moments. However, regarding the comparison between the CG and EG, positive affect was deemed significantly higher in the EG after the intervention by the Mann-Whitney test, $Z = -2.65$, $p = .008$, whereas the remaining variables did not show significant differences.

Table 5. *Differences between EG and CG's post-intervention psychological measures.*

	Control		Experimental		Mann-Whitney test	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>Z</i>	<i>p</i>
1. Trait anxiety	45.17	11.84	41.40	14.28	-.59	.552
2. Perceived stress	29.75	7.71	30.50	8.36	-.43	.667
3. PANAS						
a) Positive affect	36.25	3.49	40.80	6.58	-2.65**	.008
b) Negative affect	28.50	5.87	28.30	10.08	-.36	.715
4. Satisfaction with life	23.33	8.08	27.20	5.12	-1.03	.303
5. Subjective happiness	3.48	0.94	3.73	0.84	-.50	.619
6. Perception of performance	5.83	1.03	6.20	1.99	-1.20	.228

Table 6. *Differences between EG's pre- and post-intervention psychological measures.*

	Pre (<i>n</i> = 10)		Post (<i>n</i> = 10)		Wilcoxon signed ranked test	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>Z</i>	<i>p</i>
1. Trait anxiety	44.10	14.50	41.40	14.28	-1.722b	.085
2. Perceived stress	33.00	8.93	30.50	8.36	-1.539b	.124
3. PANAS						
a) Positive affect	38.80	5.27	40.80	6.60	-1.794a	.073
b) Negative affect	26.80	8.94	28.30	10.08	-.896a	.370
4. Satisfaction with life	25.70	4.27	27.20	5.12	-1.362a	.173
5. Subjective happiness	3.65	0.78	3.73	0.84	-.422a	.673
6. Perception of performance	6.10	1.91	6.20	1.99	-.447a	.655

Note. a. based on negative ranks; b. based on positive ranks.

Qualitative impact of the intervention

Although four participants of the EG did not finish the intervention program, the remaining participants recognised a positive impact on their daily life ($M = 3.33$, $SD = .47$), and 40% ($n = 4$) affirmed that the group strongly felt this positive impact. Moreover, participants considered the intervention highly useful ($n = 10$), easy to apply ($n = 10$), easy to learn ($n = 10$) and would recommend a similar protocol to a family member and/or

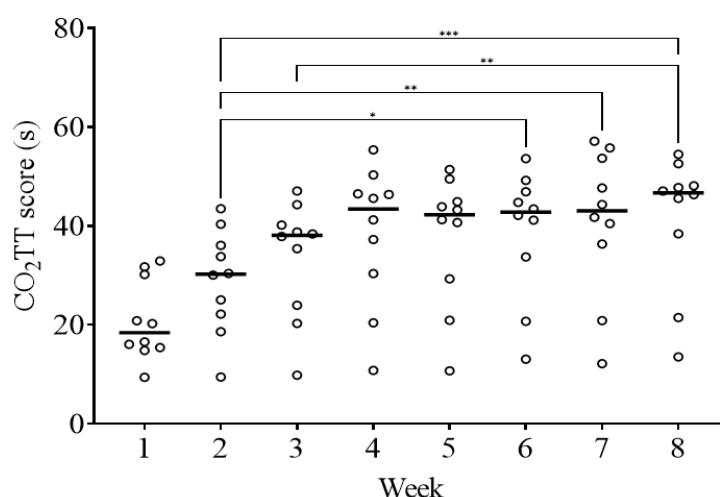
a friend ($n = 10$). Overall, participants described themselves as more relaxed ($n = 7$), more positive ($n = 3$), and more capable of dealing with stressful situations ($n = 5$), both in sports but mostly in daily life.

“I really felt that this protocol helped me feel more positive towards my day-to-day and the way I face it. (...) I was able to remain in control even in uncomfortable situations. I feel better, happier, and more at peace with life.”

CO₂ tolerance test

Results of the weekly pairwise comparison of scores of the CO₂TT through Friedman test are represented in figure 2. Significant effects of the intervention weekly development on CO₂TT were identified, $\chi^2(7, n = 10) = 55.70, p < .001$. Post-hoc Dunn's multiple comparison test identified significative differences between week 1 median score and weeks 4-8, between week 2 and weeks 6-8, and between week 3 and week 8. The significative increased in median CO₂TT scores in the latter weeks, compared to the first, imply an increase in tolerance of endogenous CO₂ through the course of the intervention.

Figure 2. *EG's CO₂TT scores: weekly pairwise comparison*



Note. Each symbol represents an individual's CO₂TT score within each week. The horizontal line represents the group median. * $p < .05$, ** $p < .01$, *** $p < .001$; Comparisons between week 1 and the rest were eliminated to clear the graph.

Discussion

The aim of the present study was to explore SPB's impact on youth female athletes' mental health and well-being, as well as the feasibility and adherence to a slow guided breathing protocol in a youth sport setting.

Despite significant differences in positive affect's between the EG and CG after the intervention, the majority of the study variables did not show significant differences. Furthermore, no significant differences were found in the psychological mental health and well-being markers between the pre- and post-intervention periods in the EG.

Findings of the present study, particularly psychological measures, are not consistent with the stress-, anxiety-reducing, and well-being promoting capacities reported in recent research on SPB and similar techniques (Laborde et al., 2022; Lehrer et al., 2020). In effect, even though both anxiety and perceived stress decreased following the intervention, a statistically significant positive impact on both anxiety and stress was expected (e.g., Perciavalle et al., 2017; Sellakumar, 2015). The same was the case for the well-being markers (e.g., Krygier et al., 2013; Peterson et al., 2017; Zautra et al., 2010).

Various factors could be responsible for the intervention's lack of statistical effect. The reduced breathing exercise duration of 5-min and/or relatively small number of sessions could not be enough for the physiological effects to take place. In fact, while You and colleagues (2021) found no differences between 5-, 10-, 15- and 20-min exercise duration in cardiac vagal activity, differences in psychological measures were not addressed both during and immediately after the session. Additionally, the effect of SPB on cardiac vagal activity is short-lived, with levels returning to normal almost immediately after exercise cessation (Laborde et al., 2022). Contrariwise, Laborde and colleagues (2019) have shown chronic increases in cardiac vagal activity in a long-term

intervention at 6 bpm (15 min/day for 30 days), almost 4x the amount of the total minutes in the present study's intervention.

In addition, the age of the intervention group, composed by adolescents, presents a challenge to the focus this type of exercise requires (Tan, 2016). Perhaps reduced session duration did not permit participants to fully engage with the breathing exercise until its latter stages, leaving little time for its effects to take place. A similar intervention by Bentley and colleagues (2022), where the participants performed 5 min sessions 3x a week for 5 weeks in a group setting also reported non-significative differences in trait anxiety, both for self-paced and guided-paced slow breathing groups.

Nevertheless, somehow contradicting the results of the self-report measures, most of the participants of the SPB group described themselves as more relaxed, capable of managing stress, and reported a shift towards a more positive mindset. Participants also found the protocol easy to learn and apply, reported a strong positive impact in their daily life and would recommend similar interventions. Likewise, significative improvements in the weekly CO₂TT imply that stress tolerance was improved. Studies in children and adolescents have shown a consistent link between CO₂ hypersensitivity and both anxiety and panic disorder (Pine et al., 2000, 2005). Equally, a study by Henje Blom and colleagues (2014) identified increased respiration rate and lower concentration of end-tidal CO₂ in adolescent girls with emotional disorders, compared with their healthy control peers. Thus, considering the significative differences between groups in positive affect following the present intervention, coupled with decreases in trait anxiety and perceived stress, findings could imply that some effects were taking place even with the short duration sessions.

Conclusions and future directions

Given the current scenario of youth's mental health, recently heightened due to the COVID-19 pandemic, accessible tools for anxiety and stress management become of the utmost importance. Focusing on the youth female athlete population, with its unique subset of problems and stressors, the present study explored the incorporation of SPB within sport practices. The feasibility of the protocol, its effects on several psychological health and well-being markers, and in physiological stress tolerance provided insights for further research in the field, as well as further similar applications.

Nevertheless, considering that the small sample size, exacerbated by four waivers in the EG, could have negatively impacted the statistical analysis (Hackshaw, 2008), future studies should endeavour to replicate this protocol in a larger sample size, which may identify significant effects of this SPB intervention. Moreover, considering its close relationship with SPB, physiological measures, specifically measuring the cardiac vagal tone through HRV, could have enriched the study's results (You et al., 2021). Besides, measuring HRV would give immediate feedback, during the session, about the presence of physical effects associated with the SPB (Sevoz-Couche & Laborde, 2022). In summary, future studies in the athletic setting should increase session duration and/or intervention time, coupled with HRV measuring and larger sample sizes.

General discussion and conclusions

The main goal of the present study was to assess youth athletes' mental health and psychological adjustment after the recent pandemic. Additionally, it also intended to explore a simple and highly accessible tool in slow-paced breathing for daily stress management, which can improve psychological health and well-being in this population. Therefore, this dissertation was divided into two studies: a broader cross-sectional study exploring the role of implicit beliefs about emotions, emotional regulation and self-control in several psychological health and well-being markers, and the second study exploring the effects of SPB as a tool for stress-management in sports practice.

Findings from the first study suggest a possible flawed emotional regulation, namely a lack of efficient cognitive reappraisal combined with a preference towards expressive suppression. Dukes and colleagues (2022) stated that adolescents are less prone to use reappraisal in emotionally charged situations when compared to adults. Contextual demands and difficulty applying the necessary cognitive skills may limit their reliance in this strategy, possibly leading to a preference of expressive suppression (McRae et al., 2012). Both inefficient use of reappraisal and the use of suppression have been shown to heighten anxiety and subsequently hinder one's emotional and cognitive well-being (Dryman & Heimberg, 2018; Haga et al., 2009).

The results also suggested that the relationship between self-control and cognitive well-being is not straightforward and could be time and/or situation dependent. Moreover, considering the importance of intersocial relationships in adolescents' well-being (Gómez-López et al., 2019), and that self-control is often associated with resisting momentary temptations in favour of long-term goals (Duckworth, 2011), it seems that high self-control could also lead to negative outcomes. This can partially explain the absence of relationship with life satisfaction and subjective happiness.

The first study also pointed to the importance of early interventions, and the potential efficacy of group school-based programmes, thus framing the second study presented in this dissertation. Findings from the application of a slow-paced breathing intervention in young female volleyball players (Study II) suggested that reducing sessions' duration to 5-min, in order to better fit the sports practice schedule, could prove insufficient to detect significant improvements in psychological health and well-being markers after 8 weeks of three weekly sessions. However, the overwhelmingly positive qualitative reports and significant improvements in CO₂ tolerance may indicate that some effects of the slow-paced breathing intervention were taking place, despite the short session duration and/or intervention length. Moreover, due to its reported easiness to learn and to include in day-to-day life, future studies should further explore the potential of similar accessible and simple interventions for stress-management and/or addressing mental illness in a youth sports setting.

Overall, both the cross-sectional and experimental studies contributed to the research field of mental health and well-being in youth athletes. Additionally, findings suggested the need for early interventions on both on-set and future mental health related concerns.

Nevertheless, individually and combined, both studies are not without limitations. Regarding the first study, some limitations include: common method variance due to all measures being self-reported by online survey; ambiguity due to only accounting for trait self-control; possible lacking representation of the complete youth sports scenario in Portugal due to the sample size, sports practiced, and gender distribution. Concerning the second study some limitations regard the small sample size and its possible negative impact on statistical analysis and the lack of physiological measures, particularly HRV, which could have given immediate feedback during the sessions and surely completed

the study's results. In addition, while targeting psychological health markers and consequently emotional and cognitive well-being, the SPB intervention lacked the educational load to address the possible emotional regulation disfunction suggested by the first study, namely the inefficient and/or insufficient reappraisal use coupled with a frequent use of suppression.

In sum, sport psychology professionals have a major role in transferring these findings to the field. Most likely by firstly educating the coaches on the importance of both mental health and well-being in current times, but also by designing interventions that could be implemented in their sports practice. It is worth mentioning that a school-based mindfulness intervention sustained in slow breathing practices and complemented with educational sessions reported a positive impact on adolescents' emotional regulation, as well as on their emotional awareness, self-regulation efficacy and stress levels (Metz et al., 2013). In addition, significant improvements on emotional regulation use were also identified by Wagstaff and colleagues (2013) after a 6-month intervention with different sport's professionals consisting of educational workshops. Accordingly, creating new programmes that target both psychological health markers and educate adolescents cognitively to better deal with stressful situations, particularly regarding the use of emotional regulation strategies, is of the utmost importance to promote their current psychological health and well-being, as well as its future implications.

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Appendices
