Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

A Pilot Study: Can Mindfulness Help High Performance Athletes?

A Masters thesis presented in partial fulfilment of the requirements for the degree of Masters of Science in Psychology.

Massey University, Wellington, New Zealand.

Taylor Rapley

2021

A Pilot Study: Can Mindfulness Help High Performance Athletes?

Abstract

To investigate whether mindfulness is effective for decreasing perceived stress in high performance athletes experiencing high levels of stress, the current single case pilot study (SCD) employed a Mindfulness Based Intervention (MBI) consisting of a video recorded mindfulness psychoeducation session, followed by the '1 Giant Mind – Learn to Meditate' phone application. Participants (N = 3) were instructed to use the '1 Giant Mind – Learn to Meditate' smartphone application and meditate once a day for 30 days. The study measured participants' perceived stress, psychological inflexibility, dispositional mindfulness and self-compassion at baseline, mid and post intervention. Mindfulness psychoeducation and meditation effectively decreased perceived stress and psychological inflexibility, and increased dispositional mindfulness and self-compassion from baseline to post intervention for all three participants, with a large group level effect across all four measures. Given that athletes are particularly vulnerable to experiencing the detriments of stress, this research is necessary to gain a better understanding of the benefits of mindfulness psychoeducation and meditation on high performance athletes experiencing high levels of stress.

Dedication

This thesis is dedicated to my mum who left us at the beginning of this project. I know how important it was for you to give me the opportunities you never had. This thesis was made possible because of the opportunities you made for me. You worked hard and loved hard, and you made me feel more than capable of pursuing any vision I mustered up from day dot. I dedicate this thesis to you.

Acknowledgements

Throughout the writing of this thesis I have received a great deal of support and assistance.

I would like to express my sincere gratitude to my supervisor Dr Ian de Terte. Your honest feedback, patience and supervision to complete this study was appreciated. You constantly challenged me, pushed me to delve deeper and think more critically. Thank you.

I owe an extremely big thank you to Iain Saunders. You were my inspiration for pursuing this Masters. The opportunities you presented me during my studies kept me motivated to stay focused. Your mentorship has meant the world to me, and I honestly don't know how I would have navigated the last few years without your support.

To my family, thank you for giving me the opportunities to get to this point.

To my mum, you always made me feel like I could do anything if I wanted it enough. You were by my side when life threw curve balls and without your endless love during that time, I doubt I would have come this far. I wish you were here to celebrate with me.

Dad, you have always been the first person to remind me of how capable I am, and that showed more than ever over the last two years. Thank you for believing in me, always.

Lastly, I owe gratitude to my partner Russ. You have spent the last year listening to me harp on about my research and psychology related topics. You held space for me to share my passion for psychology and to voice my visions and for that, I am grateful. Thank you for your encouragement when I was struggling – you keep me honest, humble and aligned with what'simportant.

Table of contents

List of Figures and Tables

Chapter One Introduction

Stress is an inevitable part of life and is especially prevalent in high performance sport (Moen et al., 2016). Research has indicated that athletes report greater numbers of stressors in their lives compared to their non-athletic counterparts (Alsentali & Anshel, 2015; Pritchard & Wilson, 2005). Athletes are generally more likely to be exposed to stressors due to the grueling demands of competition and training, regular physical strain, risk of injury, challenging team dynamics, and financial obligations while balancing competitive sport with family, relationships and other life demands (Gustafsson et al., 2015; Rice et al., 2016). Risks associated with high levels of stress in athletes include an increased risk of experiencing anxiety, depression (De Francisco et al., 2016) and burnout (Spiotta et al., 2018), as well as poor sporting performance outcomes (Bali, 2015).

MBIs have recently become popularised in the field of psychology through promoting self awareness of difficult thoughts and emotions with an attitude of nonjudgmental acceptance and self-compassion. Mindfulness is thought to influence how a person appraises and experiences stress through the disengagement of automatic thought patterns (Hyland et al., 2015), reducing perceived stress and enhancing adaptive coping mechanisms (Cayoun et al., 2018). While much of the research has been focused on how mindfulness can help clinical populations (Birrer et al., 2012), there is now evidence to suggest that MBIs can be used to help athlete populations (Gardner & Moore, 2007) decrease perceived stress (Hargrove et al., 2013; Furrer et al., 2015; Brown et al., 2007; Gustafsson et al., 2015) and psychological inflexibility (Gross et al., 2018; Carrança et al., 2019; Levin et al., 2017; Schwanhausser, 2009), and increase dispositional mindfulness (Goodman et al., 2014; Josefsson et al., 2019; Hasker, 2010) and self-compassion (Mosewich et al., 2013; Carrança et al., 2019). There is also evidence to suggest that MBIs can enhance athletic performance (Birer et al., 2012; Jones et al., 2020; Bernier et al., 2009; Dehghani et al., 2018; Schwanhausser, 2009; Josefsson et al., 2019).

Psychological Skills Training (PST) is a common approach for enhancing mental skills for the purpose performance development in athletes. PST focuses on helping athletes self-regulate their behaviour through a shift in mindset, and is delivered through several methods including imagery, visualisation, positive self talk, goal setting, arousal control, and mental rehearsal (Birrer & Morgan, 2010). However, studies surfaced suggesting that MBIs may be

more effective than PST at enhancing performance, dispositional mindfulness and emotion regulation (Josefsson et al., 2019), as well as generating nonreactivity to internal states and greater commitment to adaptive behaviours in line with performance values and goals in athletes (Hasker, 2010).

An important component of many successful MBIs is mindfulness psychoeducation (Josefsson et al., 2019; Norouzi et al., 2020; Gross et al., 2018; Hendricks et al., 2019; Castonguay & Beutler, 2006). Psychoeducation is used to educate participants on key concepts and benefits related to MBIs. Evidence has surfaced suggesting that mindfulness psychoeducation preceding meditation interventions can increase participant engagement with smartphone meditation applications (Hendricks et al., 2019). Further research has suggested that making the connection between meditation techniques and the applicability to an athlete's particular sport through psychoeducation may make athletes more open to learning and practicing meditation (Scott-Hamilton et al., 2016; Carrança et al., 2019).

Meditation is one way to practice mindfulness and is a useful tool for integrating key mindfulness skills, such as present moment awareness and experiential acceptance, into a regular practice (Brown & Ryan, 2004). Evidence has suggested that meditation is related to sustained changes in brain structure and function, as seen through changes in grey cortical matter, and increased levels of dispositional mindfulness in experienced meditators (Lazar et al., 2005). One of the more accessible ways to learn and practice meditation is through the use of a smartphone application. Studies have indicated that the accessibility of meditation smartphone applications are particularly appealing to populations who may be time poor and unable to attend regular in person meditation sessions (Hendrick et al., 2020), such as athletes.

Meditation may be particularly helpful to athletes who particularly vulnerable to the negative effects of stress which can be detrimental to both wellbeing and performance outcomes (Alsentali & Anshel, 2015; Pritchard & Wilson, 2005; Moen et al., 2016). As such, stress management a priority for many high performance athletes (Moen et al., 2016). MBIs have been successful when it comes to helping athletes not only better manage stress (Hargrove et al., 2013; Furrer et al., 2015; Brown et al., 2007; Gustafsson et al., 2015), but also decrease psychological inflexibility (Gross et al., 2018; Carrança et al., 2019; Levin et

al., 2017; Schwanhausser, 2009), increase dispositional mindfulness (Goodman et al., 2014; Josefsson et al., 2019; Hasker, 2010) and increase self-compassion (Mosewich et al., 2013; Carrança et al., 2019). The current pilot SCD had three New Zealand high performance athletes with high levels of stress participate in a 31 day mindfulness psychoeducation and smartphone meditation intervention. The focus of this pilot study was to assess whether mindfulness psychoeducation and meditation using a smartphone application would successfully reduce perceived stress and psychological inflexibility in stressed athletes, while also increasing levels of dispositional mindfulness and self-compassion from baseline to post intervention.

The following chapters are organised as follows: Chapter two provides a review of existing literature on theoretical foundations of stress, mindfulness and PST. This is followed by an overview of and relevant research on the relationship between MBIs and perceived stress, psychological inflexibility, dispositional mindfulness, and self-compassion. Included in this chapter is relevant research on types of meditation and the application of mindfulness psychoeducation and meditation using smartphone applications. Chapter three describes and justifies the procedures taken in this research. Chapter four comprises the presentation and discussion of the findings, providing analysis of participants responses. Chapter five provides a summary and evaluation of the research study including hypotheses testing, research limitations, areas for future investigation, ending with a conclusion in Chapter six.

Chapter Two Literature Review

This chapter provides a review of existing literature on theoretical foundations of stress and mindfulness. It also reviews literature on popular MBIs with athletes compared to traditional PST. This is followed by a review of the relationship between mindfulness and stress, psychological inflexibility, dispositional mindfulness and self-compassion. Finally, this chapter reviews literature on meditation as well as the use of psychoeducation and meditation smartphone applications. The aim of this chapter is to develop an argument for why psychoeducation and meditation may be helpful to high performance athletes.

1. The Human Stress Response

a. Defining Stress

Stress is a multi-faceted construct often used in a vague manner with a number of different definitions used to refer to mechanical, physical and psychological stress. It is certain that a person will experience a wide spectrum of psychological and physical stress in their lifetime. Further, stress is not an isolated response. This means that the body's response to stress will influence the mind, and vice versa (Lazarus & Folkman, 1984). To make matters more complex, the stress response varies across individuals depending on several factors including both genetic and environmental factors and their composite interactions (Le Moal, 2007).

One way to define stress is as a real or perceived imbalance between the environmental demands required for survival and the individual's capacity to adapt and respond to these requirements (Lazarus & Folkman, 1984). In line with this definition, there are two fundamental types of stressors - those that are physical and those that are psychological in origin. A stressor is something that has the potential to cause a state of stress. Physical stressors are those that have the potential to directly threaten a person's physical well-being; for example, exercise, temperature extremes, environmental toxins, physical illness, substance abuse, dehydration and injury. Psychological stressors originate at higher brain centres, often as cognitive appraisal of events that may challenge a person's well-being. Psychological stressors include emotional stress such as fear, sadness, grief and anger,

cognitive stress (such as ruminating on negative thoughts), inability to focus and poor judgement. Psychological stressors also include perceptual stress attributed to beliefs, roles, stories and attitudes. Environmental stressors can elicit physical and/or psychological stress. Environmental stressors may include stressful life events (e.g. losing a loved one), sudden catastrophes (e.g. global pandemic), daily hassles (e.g. making mistakes during training) and ambient stressors, which are more continuous, less obvious daily stressors that often go unnoticed, causing stress unknowingly (e.g. passive aggressive comments from a coach or teammate, or long hours spent travelling) (Lovallo, 2016).

Psychological stress is related to how an individual perceives stressful stimuli. Perceived stress can influence a person's psychological and physical stress response. For the purpose of this research project, perceived stress will be defined as, "a condition subjectively experienced by an individual who identifies an imbalance between demands addressed to him/her and the resources available to encounter these demands" (Kauser, 2010, p. 37). Perceived stress influences a person's emotional, cognitive, behavioural and physiological response to an event (Lazarus & Folkman 1984; Lovello, 2015). Emotional responses to stress may include feeling anxious, depressed or angry. Cognitive responses to stress may include lack of focus, negative thought patterns and poor memory. Behavioural responses to stress may include an activity being reduced or avoided, or the commencement of unhelpful behaviours that may exacerbate a person's experience of stress. Physiological responses to stress may include increased heart rate, pupil dilation, increased secretion of cortisol and glucose and muscle tension.

The multi-faceted nature of a person's stress response can be explained by The Cognitive Behavioural Therapy (CBT) Five-Part Model (Figure 1). The Five-Part CBT model is founded on the notion that a person's thoughts can affect their emotions, physiological response and behaviour. Each of the five components are interrelated, so changes in one component can elicit changes in another, and vice versa. Further, the Five-Part CBT Model suggests that environmental factors may also influence a person's cognitive, emotional, physiological and behavioural response to stress. Environmental factors may include relationship issues, loss of a loved one, working conditions and toxicity from a person's environment such as water or air pollution (Lovello, 2015). Environmental stressors can trigger a cognitive response that has an undesirable effect on a person's

emotions and therefore behaviour. For example, failure to be selected for a sports team can be perceived as a threat to a person's self-efficacy, leading to emotions of disappointment, resulting in negative thoughts about oneself and lack of self-confidence. This cognitive and emotional response to stress may lead to avoidance behaviour such as not showing up to training, which may make the problem worse (Stoeber et al., 2008). While stress is an inevitable part of daily life, especially for a high-performance athlete, perceived stress has the potential to become chronic (Luethi et al., 2009), thus harming an athlete's psychological and physical well-being, as well as performance outcomes (Raanes et al., 2019).

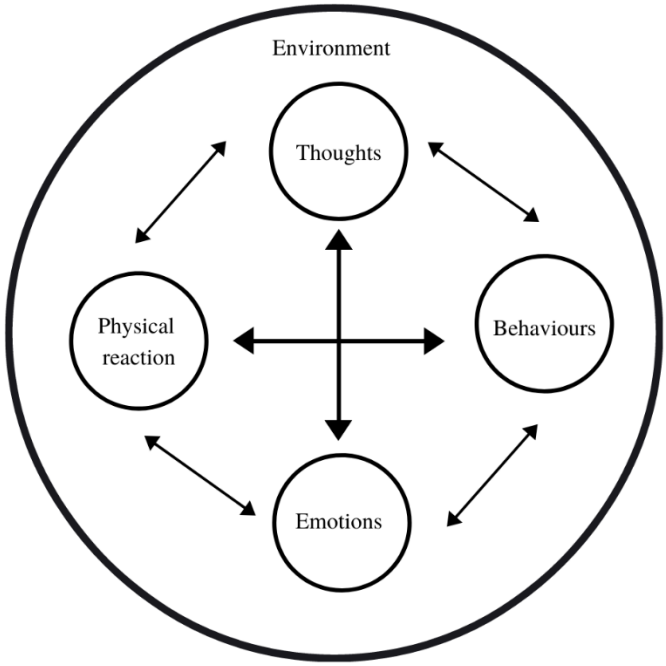


Figure 1

Note. The Five Part CBT Model explaining how each condition influences the other. Adapted from An integrated model for understanding and developing resilience in the face of adverse events by I de Terte et al., 2009. *Journal of Pacific Rim Psychology*, *3*(1), 20-26. Copyright 2009 by Cambridge University Press. Adapted with permission.

b. Stress in High Performance Athletes

Due to the nature of the high performance sport, athletes are likely to experience an array of stressors related to burnout, injury and overtraining. Increased public scrutiny through mainstream and social media, limited support networks due to relocation and travel, as well as inconsistent group dynamics in team sports, and the potential for career ending injuries all put athletes under unique physical and mental demands (Rice et al., 2016). According to a systematic review exploring the evidence regarding the mental health and well-being of elite level athletes, elite athletes are more likely than the general public to experience mental disorders such as anxiety and depression (Rice et al., 2016). Similar findings have indicated that athletes are highly susceptible to stress and burnout (Chyi et al., 2018). Further, there is evidence that athletes report higher numbers of stressors in their lives and are more likely to experience acute stress compared to their non-athletic counterparts (Alsentali & Anshel, 2015; Wilson & Pritchard 2005). Peak performance research has identified that in order to perform at a high level, athletes must be able to optimally cope with a variety of stressors because excessive levels of stress can impair sporting performance (Harmison, 2006). It is therefore important to consider how stress can have a negative effect on athlete populations.

High performance athletes are elite athletes who specialise in a single sport; they are perceived as having greater performance ability than others participating in the same sport and compete at a higher level within a sport (e.g., professional level, competing at a national and/or international level). In contrast, non-elite athletes may participate and compete in more than one sport, they do not compete at the highest level in their chosen sport(s), and they may compete only regionally or at a club level, or may not compete at all (Lorenz et al., 2013). As such, it is important not to generalise to all athletes. When it comes to athletes' experience of stress, high performance athletes are uniquely exposed to a variety of stressors, which puts them at risk of experiencing prolonged stress with a number of aversive consequences (Moen et al., 2016).

There are a number of stressors unique to high performance athletes; one of the most common stressors reported is injuries (Evans et al., 2012). An athlete's body is their livelihood; injuries that put an athlete's body out of action have high consequences. Pre and post injury factors, including personal and situational variables, can shape an athlete's

emotional and behavioural response to an injury. Research has identified that athletes experience an array of difficult emotions throughout phases of an injury. For example, feelings of helplessness, shock and anxiety are heightened at the onset of injury; while frustration, guilt and apathy are prevalent during rehabilitation, followed by impatience and re-injury anxiety after a return to sport. The interplay of these difficult emotions combined with primary and secondary cognitive appraisals of injury-related stressors may add to the overall stress experienced by injured athletes.

Further research has gone on to explain the specific stressors that can trigger stress inducing emotional responses in athletes. Evans et al. (2012) followed and interviewed ten competitive athletes from injury onset through to their return to competition and found a number of key stressors associated with how athletes dealt with their injury. Stressors reported by injured athletes included sport related demands, such as missed opportunities due to injury, which also put sponsorship contracts at jeopardy. Loss of routine, social isolation and boredom were also key stressors at the onset of their injury, while returning to sport post injury was also a key stressor. As with Wiese-Bjornstal's et al., (1998) findings, injured athletes returning to sport felt anxious about injuring themselves again and frustrated with their loss of conditioning which impeded on their ability to perform.

High performance athletes often represent their country on the world stage. Dugdale et al. (2002) investigated appraisals and coping strategies of elite New Zealand athletes faced with unexpected stressors during international competition at the 1998 Commonwealth Games. Seventy-one athletes identified having experienced high stress leading up to and/or during the games, while 34 of those athletes felt that stress had negatively affected their performance. Overall, the findings suggested that an athlete's cognitive appraisal of stress was influenced by how prepared they were for potentially distressing events associated with international competition; unexpected stressors were appraised as more threatening than expected stressors. Similar to Wiese-Bjornstal's et al., (1998) and Evans et al. (2012) findings, the most common stressor reported by athletes in the study was injury. This was followed by negative thoughts, travel, poor preparation before competition, loss of confidence and making mistakes during performance. One of the most frequently employed strategies for coping with stressors was acceptance, where athletes accepted the presence of stressors, such as injury, and did what they could to manage them in the moment. These

findings highlighted the risk associated with unexpected stressors which are more prevalent for unexperienced athletes (Kristiansen & Roberts, 2010). Dugdale's et al. (2002) findings also highlighted acceptance as a coping strategy, as well as the role of cognitive appraisal when it comes to dealing with unexpected stressors. Cognitive appraisals are important to consider when trying to understand how a person perceives and deals with stress. This is emphasised in The Transactional Model of Stress and Coping (Figure 3) which suggests that a person's experience of stress emerges not only from a situation, but also from how a person appraises the situation as being negative and as exceeding their ability to cope (Eatough, 2015). The Transactional Model of Stress is reviewed in Chapter 2 Section d.

There have been studies comparing stress and coping among student-athletes with regular students that further indicated athletes' susceptibility to stress. Wilson and Pritchard (2005) suggested that participation in sport can act as an additional stressor that non-sport participating university students do not experience. As part of their study, they found that unique stressors experienced by student athletes included extensive time demands, injuries and conflict with coaches and teammates. Lack of time and struggles to balance sporting with academic demands was one of the most common causes of stress for student athletes. Research with this group is highly relevant because many high performance athletes are required to balance their sporting commitments with other life demands such as raising a family, relationships, study and paid work outside of their sport (Burlot et al., 2018; Stambulova et al., 2015).

In the pursuit of excellence, athletes are often forced to make a number of sacrifices. Cosh and Tully (2014) conducted interviews with Australian athletes enrolled in tertiary education. Interviewees stated that they chose to sacrifice educational success in order to successfully integrate their sporting and educational pursuits; many athletes aimed to 'just pass' rather than work for higher grades. The decision to sacrifice academic performance was based on perceived time constraints, and this decision was a primary stressor. The stress inducing effects of balance high performance sport with academic commitments was further demonstrated by O'Neill et al. (2013) who conducted a cross-sectional design using qualitative techniques to examine how Australian high school athletes dealt with the pressures to perform in both sport and at school. This study revealed that challenges related to balancing sport with a social life, due to lack of time, were perceived as a key stressor in the athletes' lives. Another

issue reported by athletes was time management where athletes indicated that they needed time to 'switch off' after a long day of demanding physical and mental work. Athletes felt they could not afford this type of down time as it came at the cost of having to catch up on schoolwork or training. Both of these studies highlighted the nature of sacrifice in high performance sport and how those sacrifices can be related to lack of time (Wilson & Pritchard, 2005; O'Neill et al., 2013).

Another stressor prevalent in high performance sport is travel. For every competitive high performance athlete travel is essential and for many, international travel is frequent. Long distance travel is associated with travel fatigue. Travel fatigue can be the result of anxiety and stress associated with travelling, changes to an athlete's daily routine, and dehydration due to time spent in the dry air conditions of an aircraft. Coinciding with travel fatigue is the potential for jetlag when crossing several time zones. Jet lag is a temporary sleep disorder as a result of the body's internal clock becoming out of sync with cues (e.g., light exposure and eating times) from a new time zone. Fatigue and difficulty concentrating are common symptoms of jet lag which can last up to a week or even more. Consequently, athletes may struggle to sleep and adapt to their new environment and time zone – impeding on their performance and increasing their risk of mental stress and fatigue. The effects of sleep loss and jetlag on an athlete's mindset and performance includes altered perceived exertion where athletes find physical activity more challenging, as well as mental fatigue and loss of motivation. All of these can result in physiological and psychological stress (Waterhouse et al., 2004).

A more recent stressor perceived by high performance athletes is COVID-19 restrictions. As a way to limit the spread of the COVID-19 virus, national and interventional sporting events have been postponed, including the 2020 summer Olympic Games in Tokyo. Further, national lock down restrictions have meant that athletes cannot compete or train effectively (Mehrsafar et al., 2020). Frank et al. (2020) reported sports psychologists receiving greater demand for online services and increased diagnoses of mental disorders among athletes during the pandemic. Many athletes were fearful of being infected with the virus and athletes who were infected with the virus presented anxiety related to their physical recovery. Lack of access to training facilities, family conflicts as well as sleep disturbances were factors contributing to athletes' stress. It was further suggested that a lack of coping

mechanisms for dealing with COVID related stress may lead to some athletes to experience short or long-term depression. Reardon et al. (2019) reported key sources of stress in Olympic athletes. These included isolation from team mates, lack of social support and interactions with less qualified coaches. These stressors are also more prevalent in the current COVID climate (Mehrsafar et al., 2020). Furthermore, cancellation of leagues and competitions have also put professional athletes in difficult financial situations causing financial stress (Toresdahl & Asif, 2020).

Financial obligations have been a known stressor by athletes long before the pandemic hit. Even without the financial pressures that have come with COVID restrictions, the risk of losing scholarships, sponsors and contracts that come from an athlete's performance, creates immense pressure to perform. If an athlete's sport is not funded or if they are not at a level where their costs are paid, athletes often have to raise money themselves. This may mean applying for financial scholarships, working in the off season and applying for sponsorship. The stress associated with not being able to pay for a training camps or to travel for competitions can be high. Having to worry about money in addition to performance can create a great deal of stress, as indicated in interviews with 20 Australian university student athletes about their encounters with numerous stressors. Athletes repeatedly mentioned the impact of financial stress, exacerbated by costs associated with travel for sport, often reporting lack of money to pay for competition travel as the biggest issue (Cosh & Tully, 2015).

There is evidence that athletes report many stressors in their lives (Alsentali & Anshel, 2015; Wilson & Pritchard, 2005) and that, in general, athletes are susceptible to experiencing acute stress. Acute stress can result from time constraints (Cosh & Tully, 2015), executing the wrong play, losing, injury, poor performance, and negative encounters with teammates, competitors and coaches (Alsentali & Anshel, 2015; Gan & Anshel, 2009). Risks associated with high stress in athletes include high rates of burnout (Spiotta et al., 2018; Gustafsson et al., 2013) and increased their risk of anxiety and depression (De Francisco et al., 2016). It is apparent that high performance athletes are exposed to a many stressors that may not be as prevalent in non-elite athletes (Alsentali & Anshel, 2015). It is therefore important to understand how high-performance athletes experience stress and how negative stress can be better managed.

c. The Stress Response Curve

Stress is often conceptualised as a negative construct. However, what may be perceived and experienced as stressful to one person, may not be stressful to another (Cohen & Williamson, 1988). Perceived stress can determine whether a stressful event has a positive or negative effect on a person's well-being and performance. In this sense, it is not stress that is problematic, but rather how a person perceives stress (Gardner, 2009; Lazarus & Folkman, 1984). The idea that certain levels of stress are not always harmful is demonstrated by the Human Stress Response Curve depicted in Figure 2 (Bali, 2015) which suggests that "increasing stress is beneficial to a person's performance until some optimal level is reached." (O'Sullivan, 2011, p. 156).

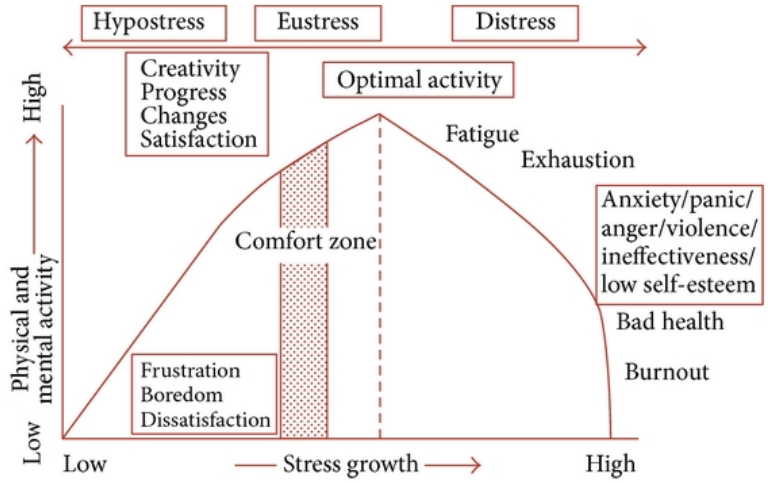


Figure 2

Note. The Human Stress Response Curve depicts how different levels of stress can result in different outcomes. Reprinted from The reduction of distress using therapeutic geothermal water procedures in a randomized controlled clinical trial by L. Rapolienė et al., 2015 *Advances in Preventive Medicine*, 1-10. Copyright 2015 by Lolita Rapolienė reprinted as an open access article under the Creative Commons Attribution License.

According to the Stress Response Curve, too little stress can result in frustration, boredom and dissatisfaction. This type of stress is called hypostress and occurs when a person suffers from too little stimulation. For example, a factory worker repeating the same tasks for long periods of time may experience a state of hypostress which has the potential to develop into depression (Faizan & Haque, 2019; Lazrus & Folkman, 1984). An example of hypostress in athletes may be when an athlete becomes injured and is unable to participate in their sport. While distress is commonly associated with demands outweighing resources, hypostress becomes apparent when resources exceed demands. A person under hypostress may not be challenged to use their resources, often leading to burnout (Smith, 1986).

On the contrary, too much stress can also lead to burnout, as well as anxiety, low self-esteem and being overwhelmed (Faizan & Haque, 2019). This is known as distress, which is an aversive negative state whereby coping and a person's ability to adapt in response to stressors fails, resulting in psychological and physical stress. An example of distress in athletes may be experienced during high intensity training blocks where athletes are likely to experience an array of psychological and physical stress responses including mood disturbance, fatigue, burnout and injury, all of which may result in poor performance outcomes (Main & Grove, 2009). The transition to a state of distress is due to many interrelated factors including stressor duration and intensity as well as predictability, controllability and stress appraisal. A person is usually able to adapt under short term low intensity stress. However, prolonged low and high intensity stress will likely lead to several adverse physiological and psychological consequences (O'Connor et al., 2010; Lazarus & Folkman, 1984).

Optimal stress exists between a state of hypostress and distress and leads to optimal performance as well as enhanced creativity, growth, progress, and satisfaction and is usually due to more manageable levels of stress. This type of optimal stress can be experienced as "a positive psychological response to a stressor" (O'Sullivan, 2011, pp. 155). Optimal stress is also known as eustress and is defined as a positive form of stress that has a beneficial effect on health, motivation, performance, and emotional wellbeing. Eustress is characterised by an increase in energy, excitement, motivation, increased coping skills, mastery and optimal performance (Li et al., 2016). Eustress has also been linked with heightened experiences of flow state (Peifer et al., 2014), characterised by undivided attention to the task at hand, a

distorted experience of time, less self-referential thoughts and optimal performance; flow state is a highly sought-after experience by any performer (Jackson et al., 1996),

d. The Transactional Model of Stress

Individual differences in stress perception are demonstrated by the Transactional Model of Stress and Coping (Figure 3) which suggests that a person's experience of stress emerges not only from a situation, but also from how a person appraises the situation as being negative and as exceeding a person's ability to cope (Eatough, 2015). Further, a person's experience of stress is based on a combination of a person's perception and assessment of the situation (e.g., the individual perceiving whether or not the stressor exceeds available resources) and coping mechanisms (e.g., purposeful strategies to manage or overcome stressful situations) (Lazarus & Folkman, 1984). For example, individuals who perceive stress as a threat are more likely to experience distress (O'Sullivan, 2011, p., 156). In contrast, individuals who perceive stress as a positive challenge are more likely to experience and benefit from a state of eustress (Dhabhar, 2018). Given that appraisals mediate the relationship between stressors and outcomes (Kausar, 2010), and that alternations in how a person thinks about stress can influence a person's experience of stress and associated behavioural outcomes (O'Sullivan, 2011; de Terte et al., 2009), it is important to consider cognitive appraisal when understanding how an athlete perceives stress.

The Transactional Theory of Stress and Coping suggests that a person's appraisal of stress shapes their experience of stress and therefore their performance; this been demonstrated in research. O'Connor et al. (2010) investigated how stress and cognitive appraisal were experienced by negotiators, and how appraisal influenced their performance. The results suggested that those who appraised the situation as threatening experienced greater levels of perceived stress and performed worse. In comparison, those who appraised the situation as challenging experienced less stress and performed better. Additional research into the benefits of challenge cognitive appraisals has been conducted with athlete populations. Williams et al. (2010) conducted study with twenty healthy athletes; the authors explored whether imagery could change athletes' appraisal of stressful situations (i.e., challenge or threat) and whether psychological and cardiovascular responses and interpretations varied depending on cognitive appraisal of three imagery scripts which

elicited challenge, neutral, and threat appraisal. The results found that the threat script elicited greater cognitive anxiety compared to the challenge script. Interestingly, increased anxiety was perceived as helpful during the challenge script, but not during the threat script. The results further suggested that negative emotions can be experienced during a challenge state while still facilitating performance. This study has demonstrated how negative emotions such as anxiety, can facilitate optimal performance if the stressor inducing such emotions is appraised as a challenge rather than a threat. This idea that negative emotions can exist without impeding on an athletes ability to perform is promoted through many MBIs where athletes are taught to redirect their attention to focus on task relevant skills, rather than focus on potentially distracting thoughts and emotions (Gross et al., 2018).

Gardner and Moore's (2006) Integrated Model of Athletic Performance demonstrates a relationship between stress appraisal, stress and mindfulness. An athlete's thoughts, emotions and behavioural responses to a stressor are a result of existing schemas based on past experiences that influence how an athlete perceives and responds to a potentially stressful event. In the context of mindfulness, Hyland et al. (2015) suggested that mindfulness influences how an athlete appraises a stressor by promoting a present moment experience of what is, rather than an inaccurate 'commentary' based on emotional filters, automatic thought patters and cognitive schemas. Further, (2012) suggested that mindfulness helps individuals become less prone to negative cognitive processes related to rumination and catastrophising and may enhance adaptive coping mechanisms related to a stressful event post appraisal. It has also been demonstrated that dispositional mindfulness achieved during meditation significantly predicts reappraisal over time, whereby mindfulness promotes emotion regulation in the face of potentially distressing events by enhancing positive cognitive reappraisal (Garland et al., 2015). Positive reappraisal is a key aspect of meaning based coping that helps individuals successfully adapt to stressful life events. Mindfulness is a metacognitive form of awareness that involves the shifting of cognitions to enable a more accepting, nonjudgmental appraisal of stressful life events (Garland et al., 2009). As such, it is important to consider cognitive appraisal and coping when assessing the relationship between mindfulness and stress.

According to the Transactional Model of Stress and Coping, there are two stages of appraisal when a person encounters stress. Primary appraisal is an initial evaluation of the

situation in terms of threat to a person's well-being. If a situation is appraised as threatening, secondary appraisal occurs. Secondary appraisal assesses the ability to cope with the situation by weighing up situational demands, such as difficulty, risk and resources, social support, level of experience and other coping mechanisms. When demands outweigh resources a person will likely perceive a situation as threatening, leading to a state of distress. At the onset of distress, a person will likely engage in coping strategies which are either problem focused or emotion focused (Lazarus & Folkman, 1984). The third component of stress appraisal demonstrated by the Transactional Model of Stress and Coping is re-appraisal. Once a coping strategy has been applied a person will reassess its threat value by a re-appraisal of the stressful event in the context of new beliefs and behaviours. The threat value of an event is continuously modified by emerging coping strategies where the goal is to reduce a person's experience of stress (Lazarus & Folkman, 1984). For example, a person expressing overt anger in response to stress may experience feelings of guilt or shame. In this case, the initial appraisal of threat may "create a succession of changing emotions and appraisals that follow an earlier appraisal in the same encounter, and modifies [sic] it" (Lazarus & Folkman, 1984, pp. 38).

Coping is defined as "constantly changing cognitive and behavioural efforts to manage specific external or internal demands." (Kausar, 2010, pp. 33) and can grouped into three main coping strategies: task oriented, emotion oriented, and avoidance oriented. A task oriented coping strategy is problem focused, and is an approach to coping whereby a person takes direct action in pursuit of altering the stressful situation as a way of reducing the amount of stress it evokes. In an emotion oriented strategy, a person attempts to alter emotional responses to stressors such as cognitively reframing the problem in a way that it no longer evokes a negative emotional response. This is based on the notion that changing thoughts or beliefs about a stressful event will alter a person's emotional and behavioural response to a stressful event (Zakrajsek & Blanton, 2017), and aligns with many popular PST strategies such as positive self talk (Josefsson et al., 2019). Avoidance coping includes strategies such as avoiding the situation, denying its existence, or losing hope is characterised by efforts to adapt to stressors by distancing oneself, evading the problem, or engaging in distracting tasks in an attempt to reduce feelings of stress (Lazarus & Folkman, 1984). In the context of mindfulness, avoidance coping is known as experiential avoidance, and is charactertised by an unwillingness to experience unwanted thoughts, feelings, and sensations, paired with attempts to change or avoid these private events. Experiential avoidance is related to psychological inflexibility

(Gardner & Moore, 2007). Psychological inflexibility is when psychological reactions are driven from thoughts and emotions that may dominate over values driven behaviour (Bond et al., 2011).

Coping strategies can be adaptive in that they can help a person better deal with stress in the long term, or they can be maladaptive whereby they may reduce stress in the short term through experiential avoidance (Carrança et al., 2019), but make a person's experience of stress worse in the long term. In summary, task oriented and emotion oriented approaches are associated with better adjustment to stressful situations, while avoidance coping may reduce perceived stress and associated negative affect for a short time but result in a poorer adjustment in the long term (Kausar, 2010). The detriments of avoidance coping are important to consider in the context of stress and mindfulness as avoidance coping is associated with greater psychological inflexibility, negative affect and poor performance in athletes (Henrikson et al., 2019). MBIs promote acceptance to counter avoidance coping as a more adaptive coping mechanism in the face of stress (Gardner & Moore, 2004).

Research has demonstrated the negative affects of avoidance coping, and the positive affect of experiential acceptance. Roemer and Orsillo (2002) found avoidance coping to be prevalent in people with Generalised Anxiety Disorder who reported greater fear of and discomfort with anxious thoughts and feelings than non-anxious control participants. Symptoms of worry in people with Generalised Anxiety Disorder were negatively reinforced by experiential avoidance of anticipated emotional discomfort, which may have contributed to anxiety becoming a disorder. Mindfulness Based Cognitive Behavioural Therapy Interventions have been shown to counter maladaptive avoidance coping in people with Generalised Anxiety Disorder by teaching participants to become more aware of and accepting of their emotions as a means of reducing symptoms of worry. An exception to the disadvantages of avoidance coping was observed in Bahramizade and Besharat's (2010) study which found that an avoidance coping style was positively related to performance for male athletes, whereas approach style coping was negatively related to performance for both male and female athletes. One possible explanation for the detriments of approach coping during play may be because time spent focusing on stressors, such as unfair calls made my referees, is time spent not focusing on the execution of relevant skills required for optimal performance. Similar findings

were observed in a study with table tennis players where avoidance coping was associated with less negative affect and greater performance during a match (Anshel & Anderson, 2002).

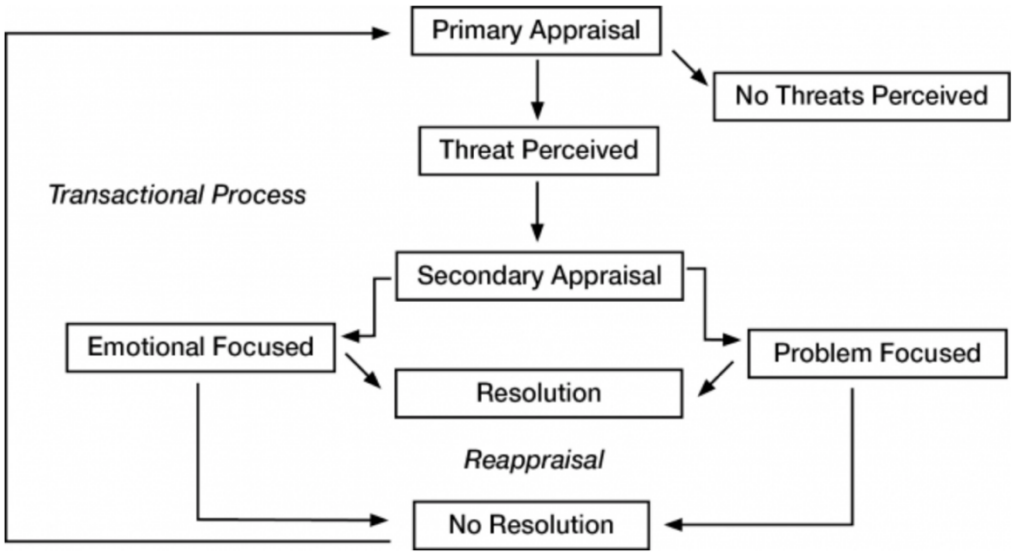


Figure 3

Note. The Transactional Model of Stress and Coping presents stress as a product of a transaction between a person (including multiple individual variables) and their environment. Reprinted from Stress, Appraisal, and Coping (p. 150-153), by R.S Lazarus and S. Folkman et al., 1984. Copyright 1984 by Springer Publishing Company, Inc. Reprinted with permission.

As seen by the Transactional Model of Stress and Coping, a person's experience of psychological stress is an interplay of complex processes, the person, and the person's environment whereby appraisal of that interaction is deemed as threatening. Appraisal can occur at any point from encountering a stressor to the experience of stress, and interplays with a person's coping mechanisms (Zakrajsek & Blanton, 2017). Stress is therefore a complex, multifaceted process, largely influenced by individual differences in appraisal and coping. Because processes of appraisal and coping will change over time and across different encounters, stress is a moment-to-moment experience (Lazarus & Folkman, 1984); and because

stress changes over time and varies across individuals, research investing perceived stress in response to mindfulness must account for regular reports of perceived stress over time.

e. Zone of Optimal Functioning

When considering the relationship between stress and performance there are many other variables to account for which may impact how an athlete experiences stress and ultimately how an athlete achieves optimal stress. The Zone of Optimal Functioning suggests that individuals perform optimally at different levels of arousal depending on individual and task-related differences. Therefore, not all athletes experience eustress at the same point in the stress response curve. Personality, task type and stage of learning all influence an athlete's relationship to stress and performance. For example, introverts perform better at low levels arousal whereas extroverts perform better at higher levels of arousal. Simple tasks are performed better at high arousal levels, whereas complex performed tasks are performed better in low levels of arousal. At the autonomous stage of learning (skills become automated), a person performs better at high levels of arousal, while a person at cognitive and associative stages (learning and executing new skills) of learning will perform better in low levels of arousal (Krane, 1993).

The Zone of Optimal Functioning is important to consider when understanding the role of stress with high performance athletes as it highlights the complex nature of stress, especially in the context of sport and performance (Krane, 1993). Recognising individual differences in stress is essential as no two athletes are the same. MBIs promote enhanced self-awareness which may encourage athletes to better understand their own zones of optimal performance. With greater awareness and additional skills acquired through mindfulness training, such as defusion and acceptance, athletes are better able manage stressors that may act as a barrier towards triggering their zone of optimal performance (Bulğay et al., 2020).

f. Positive stress (eustress)

The notion that a person's experience of stress is influenced by how a person appraises a situation as being negative or positive in relation to a person's capacity to cope is expressed in Seyle's (1975) definition of stress which accounts for both negative (distress)

and positive (eustress) experiences of stress. As cited in Crum et al. (2020, p. 121), Seyle defined stress as "the non-specific response of the body and mind to any demand made upon it". Eustress can be experienced as a positive physiological response to a stressor, as well as a positive cognitive response to a stressor associated with positive thoughts and feelings. The main factor that determines whether a person experiences eustress is their perception of the intensity of the stressor as well as its source, duration, controllability and desirability (Kupriyanov & Zhdanov, 2014).

This notion that stress can be adaptive has been supported in studies that have shown a link between eustress and the experience of flow state, where moderate sympathetic arousal and HPA-axis activation elicited task-related flow experience, suggesting some level of optimal stress was required for the experience of flow state to occur (Peifer et al., 2014). A key elicitor of flow state is when the skills of a person and demands of the activity are in balance and are both above average (Csikszentmihalyi & LeFevre, 1989). In this sense, a person experiencing flow state is being positively challenged (Jackson & Marsh, 1996). Research on flow state and performance has shown eustress to be a key precursor for flow experience. Peifer et al., (2014) conducted a study with 22 healthy males who were exposed to moderate physiological stress whilst undergoing a complex computer task. Results showed that moderate sympathetic arousal and HPA-axis activation were linked to increased self-reports of task related flow experience, whereas excessive physiological stress impaired task-related flow experience. The study indicated that moderate stress may elicit task-related flow experience, further demonstrating an inverted U-shaped relationship of flow experience and stress. MBIs have been shown to increase an athletes experience of flow state (Carrança et al., 2019; Aherne et al., 2011; Kaufman et al., 2009). For example, Aherne et al. (2011) investigated the relationship between mindfulness training and flow with 13 university athletes. Post intervention testing suggested a large difference in flow experience in the mindfulness group compared to the control group. Additional studies have further demonstrated a positive relationship between flow state and athlete performance (Jackson & March, 1996; Jackson, 2011).

Research with athletes has also demonstrated the positive effects of eustress. Moen et al. (2016) investigated the effects of eustress on athlete burnout and performance in a sample of 318 junior elite athletes. Burnout is a multifaceted concept defined in sport as "a reduced

sense of personal accomplishment, emotional (or psychological) and physical exhaustion, and a feeling of sport devaluation" (Garinger et al., 2018, p. 715). Multiple regression analysis showed that eustress correlated negatively with athlete burnout and positively with performance, while distress correlated positively with athlete burnout and negatively with perceived performance.

Findings indicative of the positive effects of eustress on performance and burnout can be explained by the Transactional Model of Stress whereby a person's appraisal of being able to cope with situational demands may be necessary to prevent distress and stimulate eustress (Lazarus & Folkman, 1984). In support of this, Titze et al. (2021) conducted a cross-sectional study to assess the relationship between psychosocial pain response patterns in response to lower back pain and associated outcomes related to mood and training frequency in high-performance athletes. The results of the study found that eustress endurance responses (cognitions of focused distraction from pain) led to more positive moods despite the pain, as well as less self-reported avoidance behaviour than those who exhibited distress-endurance responses. These findings suggested that coping mechanisms characterised by eustress in response to pain can be considered dysfunctional in that they may be helpful in the short term (e.g., enduring necessary pain related to performance outcomes) but may have long term consequences associated with avoidance coping.

In pursuit of excellence, optimal stress is key to optimal performance (Moen et al., 2016). Stress appraisal, eustress, flow and mindfulness are interrelated whereby the benefits of mindfulness with athletes have been charactertised by more positive appraisals of stress (Wendling, 2012) and an increase in flow state (Jackson & Marsh, 1996).Further, studies have demonstrated that a relationship between mindfulness and athletes' experience of flow state (Cathcart et al., 2014), while other studies have suggested a positive relationship between flow state (Carrança et al., 2019; Aherne et al., 2011; Kaufman et al., 2009) and performance (Jackson & March, 1996; Engeser & Rheinberg, 2008). Interventions with stressed athletes should be less concerned with reducing stress in general, and more concerned with regulating stress while enhancing eustress during performance (Moen et al., 2016).

Much of the research on stress has focused on the negative effects of stress, making it easy to generalise that all stress is bad (Peifer et al., 2014). However, the idea that a person's experience of positive stress is largely determined by how a person appraises a stressful situation is important to consider, especially when it comes to high performance athletes who need certain levels of stress to experience eustress and perform optimally (Moen et al., 2016; Peifer et al., 2014). However, research has shown that coping mechanisms which elicit a state of eustress may benefit athletes in the short term, but may be detrimental in the long term (Titze et al., 2021). Consequently, it is equally important to consider how stress may be detrimental to athletes, not only for the sake of their performance but also their mental health and well-being.

g. Negative stress (distress)

Distress can be experienced as a negative physiological response to a stressor, as well as a negative cognitive response to a stressor associated with negative thoughts and feelings. Similar to eustress, the main factor that determines whether a person experiences distress is a person's perception of the intensity of the stressor as well as its source, duration, controllability and desirability (Kupriyanov & Zhdanov, 2014; Hargrove et al., 2013). When a person experiences distress, they are likely to perceive a stressor as a threat, something that is either intense or long lasting and out of their control, where the demands of the stressor exceed their ability to cope (Kupriyanov & Zhdanov, 2014).

Like eustress, distress is experienced both physically and mentally. Physical origins of all stress start with the neuroendocrine system which plays a key role in the relationship between perceived stress and health outcomes through the function of the HPA axis, which regulates a range of physiological and behavioural responses to stress. Perceived stress stimulates the sympathetic nervous system, releasing norepinephrine and epinephrine neurotransmitters. These neurotransmitters signal the HPA axis to release cortico-signaling hormones responsible for the release of the hormone cortisol. Rises in cortisol are a central indicator of the stress response. Cortisol can be adaptive in that it helps the body adjust to stressful events through increased blood pressure and cardiac output for efficient physical exertion, increased levels of glucose to provide the body with extra energy (Lovallo, 2016) and enhanced task performance, as seen during eustress (Peifer et al., 2014). But this only serves

an individual to a certain point (Akinola & Mendes, 2012; Luethi et al., 2009). When stress becomes prolonged, the HPA axis response can lead to poor physical and psychological outcomes. Studies have shown high stress increases levels of cortisol, and elevated cortisol levels can suppress the immune response, making individuals more vulnerable to infection (Dhabhar, 2018). Prolonged HPA axis activation has also been linked to type II diabetes as well as cardiovascular disease, obesity and inflammatory disease (Silverman & Sternberg, 2012). Acute stress can lead to an increase in inflammation and other neurophysiological changes that regulate emotional, cognitive, and behavioural processes. One study found a relationship between stress induced inflammation and emotional attention, whereby psychological stress triggered an inflammatory response and affective-cognitive changes that contributed to the onset, maintenance, and recurrence of depression (Maydych, 2019).

Studies have suggested have demonstrated a relationship between high levels of perceived stress and poor mental health outcomes. A cross-sectional study examined the effects of stress on anxiety and depression with a sample of 321 medical students. The stress model used in the study was based on the Transactional Model of Stress which included the use of self-regulation resources as a coping mechanism, as well as perceived stress levels and its consequences on emotional distress. The study showed that higher levels of perceived stress were positively related to higher levels of anxiety and depression. Interestingly, participants who reported greater levels of emotional distress also scored higher on personal resources including joy, optimism, self-efficacy and resilience compared to validation samples. It was concluded that personal resources were not enough to buffer students perceived stress to reduce the levels of depression and anxiety (Heinen et al., 2017).

Heinen's et al. (2017) study is important finding to consider because many popular PST interventions used with athletes are predominantly outcome focused, often emphasising the importance of developing particular personal resources, such as optimism and confidence as a way to manage stress and enhance performance (Goodman et al., 2014). PST refers to "systematic and consistent practice of mental or psychological skills for the purpose of enhancing performance, increasing enjoyment or achieve greater sport and physical activity self-satisfaction" (Birrer & Morgan, 2010, p. 78). Based on Heinen's et al (2017) findings, it is worth questioning whether a focus on developing personal resources through PST is helpful for athletes with high levels of perceived stress, or whether other approaches, such as MBIs,

may be more helpful in managing perceived stress in athletes, especially when it comes to managing or preventing stress related depression and anxiety (Arch et al., 2012; Hofmann et al., 2010; Furrer et al., 2015)

Stress can also have a negative effect a person's cognitive ability via changes in the brain's prefrontal cortex (Cerqueira et al., 2007). The prefrontal cortex is an area in the brain essential for working memory and executive functioning (selecting and successfully monitoring behaviours that facilitate the attainment of chosen goals). The working memory is key for temporarily holding incoming information allowing for the manipulation of new and stored information. Studies have shown perceived stress to be linked with poor memory and cognitive function (Gutshall et al., 2017; Porcelli et al., 2008; Taverniers et al., 2010). More specifically, studies have demonstrated negative effects of acute stress on working memory task performance. Using cold water immersion, Porcelli et al. (2008) conducted a study with eighteen medical students as they performed a delayed response working memory task during exposure to different levels of stress eliciting conditions. Results found that participants in the acute stress condition performed significantly slower on high working memory demand tasks compared to low working memory demand tasks when compared to the low stress condition group. Further, functional magnetic resonance imagery (fMRI) scans showed greater prefrontal cortex activity in the acute stress condition during the high working memory demand tasks than the low working memory demand tasks. Observed excessive prefrontal cortex activity in response to stress can be explained by a "hyperdopaminergic" response whereby high levels of dopamine released by the prefrontal cortex during stress couple with specific proteins. This stress elicited coupling effect has been shown to impair prefrontal cortex signaling mechanisms which, in turn, have been shown to compromise both cognition and behaviour in demanding situations.

To the best of our knowledge, there has been one study examining the effects of stress on cognitive ability in athletes. Chang's et al. (2017) investigated the differences between types of sport (e.g., a sport with long-duration/simple motoric skills ***vs.*** a sport involving complex motor skills) on general cognition in high-level athletes compared with a control group. Although this study did not measure the effect of stress on cognition, the authors drew on several studies which suggested that highly intense or excessive training can result in oxidative stress which has been linked to impaired cognitive ability (Padurariu et al., 2010). Chang et al.

(2017) found that although there were no cognitive differences between different sport groups, two of the groups reported burnout related symptoms and fatigue from high intensity training, suggesting that overtraining may offset the exercise-related cognitive functioning benefits found in other research. The authors further suggested the importance of monitoring athletes' levels of stress to prevent such detriments. The study highlighted how optimal levels of physiological stress triggered by exercise can, to an extent, aid cognitive performance, and that when exercise induced physiological stress exceeds optimal levels, cognitive ability may become impaired.

Another disadvantage of negative stress is burnout. Burnout is a reaction to chronic stress and is a major concern for high performance athletes. It is not uncommon for athletes to drop out at the peak of their career or early on in their career due to burnout (Smith, 1986). The cognitive affective stress model is the most influential model on burnout and suggests that burnout is a result of four processes, including appraisal of stress based on whether demands exceed resources to cope, and physiological responses that reaffirm the appraisal of stress (De Francisco et al., 2016). Research has shown that prolonged psychological stress may increase athlete burnout, where athletes become unmotivated to participate in training and competition due to feeling extremely dissatisfied with or exhausted from their involvement in sport. Athlete burnout is also characterised by high levels of perceived stress which has been shown to result in reduced performance and increased drop out rates (Spiotta et al., 2018). Chronic psychological stress associated with athlete burnout can also increase an athlete's level of anxiety and increase their risk of depression. De Francisco et al. (2016) investigated the relationship between stress, depression and burnout in a sample of 453 athletes. The findings suggested that athletes who reported high levels of perceived stress also reported high levels of burnout and perceived stress and burnout predicted symptoms of depression.

It is clear that perceived stress affects individuals differently depending on the individual appraisal of a stressful situation (Raanes et al., 2019), and whether a person believes that they have the resources to be able to cope with a particular stressor (Lazarus & Folkman, 1984). There are a number of negative effects related to the experience of distress on a person's physical (Dhabhar, 2018; Sternberg, 2012; Koch et al., 2020) and mental well-being (Heinen et al., 2017; Garinger et al., 2018; De Francisco et al., 2016), as well as performance outcomes (Porcelli et al., 2008; Taverniers et al., 2010). Although still limited, there is increasing research

on the use of MBI's for managing perceived stress within athlete populations (Gardner, 2009). Such research has suggested that mindfulness may be an effective tool for helping athletes better manage inevitable stressors associated with the unavoidable demands of high performance sport (Schwanhausser, 2009; Carrança et al., 2019; Josefsson et al., 2019; Baltzell et al., 2014; Goodman et al., 2014; Gross et al., 2018). It is therefore important to explore whether a MBI may be helpful to high-performance athletes with high levels of perceived stress.

2. Defining Mindfulness

In recent years, there has been increasing interest in mindfulness and meditation and how it relates to human behaviour. The most common definition for mindfulness is "paying attention to one's present moment to moment experience purposefully, with a non-judgmental attitude." (Kabat-Zinn, 2003, p.8). Many definitions of mindfulness have evolved over time, starting around 2500 years ago with ancient Buddhist wisdom and philosophy (Granberg, 2018). There have been various attempts at quantifying this ancient concept to describe mindfulness into psychological terms for the purposes of modern research (Desbordes et al., 2015). Today, mindfulness has become integrated with modern psychology as a means of increasing awareness and promoting adaptive responses to mental processes that may otherwise result in emotional distress and maladaptive behaviour (Bishop et al., 2004).

In psychology, mindfulness is commonly delivered through MBIs through a combination of mindfulness psychoeducation and the acquisition of knowledge and skills promoting present moment awareness, defusion, acceptance, psychological flexibility and self-compassion (Cullun, 2010). Present moment awareness can be defined as the "continuous monitoring of experience with a focus on current experience rather than preoccupation with past or future events" (Donald et al., 2016, p. 3). Defusion is the ability to view thoughts as thoughts rather than a representation of present reality that requires action. Defusion aims to minimise the influence of thoughts on behavioural responses in order to promote adaptive behaviour and valued living (Levin et al., 2017). Acceptance is a willingness to experience internal events without defence and in alignment with values-driven behaviour (Roemer & Orsillo, 2002). Mindfulness also includes an element of self-compassion, where a person responds to internal events with self-kindness rather than harsh

self-judgment, recognising that imperfection is part of the shared human experience. The three main facets of self-compassion are kindness, common humanity and mindfulness (Neff, 2003). In general, facets of mindfulness include present moment awareness, defusion (Josefsson et al., 2019), acceptance (Brown & Ryan, 2003), and self-compassion (Mosewich et al., 2013). The facets of mindfulness work together to enhance a person's ability to adaptively respond to mental processes that may otherwise contribute to emotional distress and maladaptive behaviour (Shapiro et al., 2008). This can be achieved through a combination of both knowledge and skills, such as psychoeducation and meditation (Van Der Zwan et al., 2015).

Present moment awareness is a fundamental component of mindfulness, as seen in various definitions of mindfulness, many of which include present moment awareness (Granberg, 2018). Common ways to practice mindfulness include observing present moment experiences such as the breath, body sensations, thoughts, emotions and surroundings with a nonjudgmental and accepting attitude (Cullen, 2011). When a person is attentive to the present moment, they are less consumed by thoughts of the past or worry over possible future events (Atchley, 2011). Present moment awareness is also a prerequisite to experiential acceptance and defusion whereby a person must be aware of their thoughts before they can fully accept the thoughts, and engage in defusion (Gardner & Moore, 2007). Central to present moment awareness and Kabat-Zinn's (2003) definition of mindfulness is the notion of nonjudgmental awareness, making mindfulness a unique construct in the field of psychology in that it does not strive for mental control in an attempt to change the content of negative thoughts and emotions (Birrer et al., 2012). Instead, mindfulness promotes a willingness to experientially accept all internal experiences as they arise, while changing the way a person relates to such experiences (Gross et al., 2018). Experiential acceptance a key mechanism of change in mindfulness and a key component of many popular MBI's including Acceptance Commitment Therapy (ACT) (Hayes et al., 2004), Mindfulness Acceptance Commitment Therapy (Josefsson et al., 2019) and Mindfulness Based Cognitive Behavioural Therapy (Cayoun et al., 2018). The concept of acceptance can be further understood by the mindfulness principle of equanimity. Equanimity is described as having a mutual response to something whereby a person does not feel aversion to an unpleasant experience and is defined as "an even-minded mental state or dispositional tendency toward all experiences or objects, regardless of their origin or their affective valence (pleasant, unpleasant, or neutral" (Desbordes et al., 2015, p.1).

To understand mindfulness as more than just a state of awareness, Baer et al. (2008) created a model of mindfulness to depict the relationship between dispositional mindfulness and meditation. The model included facets of nonjudgment and nonreactivity to inner experiences, as well as describing and observing, as included in the Mindfulness Attention Awareness Scale. The model suggests that describing, nonjudgement and nonreactivity significantly mediate the relationship between meditation practice and psychological well-being in meditators. Higher scores for describing, nonjudging and nonreactivity suggest that meditators learn to respond to the internal stimuli they observe without judging and reacting to them in maladaptive ways, and are better at labelling observed stimuli with words. This model of mindfulness is important as it shows how the benefits of mindfulness are mediated by processes which include more than just a state of present moment awareness.

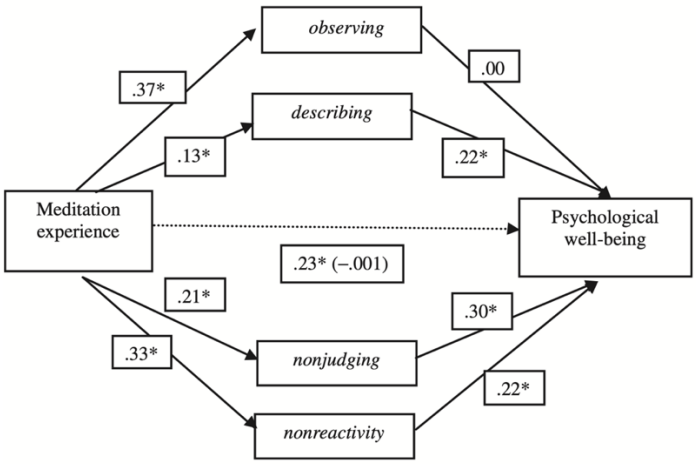


Figure 4

Note. Mediation by mindfulness facets of the relationship between meditation experience and psychological wellbeing in a combined sample of meditators and demographically similar nonmeditators. All values are beta coefficients. The coefficient in parentheses shows the relationship between meditation experiences and psychological wellbeing (*p < .05). Reprinted from Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples by R. A. Baer et al., 2008. *Assessment,* 15(3), 329-342. Copyright 2008 by Sage Publications. Reprinted with permission.

Figure 4 is in line with Bishop's et al. (2004) two part conceptual and operational definition of mindfulness which states mindfulness is a process of regulating attention in order to bring a quality of non-elaborative awareness to current experience, and a quality of relating to one's experience within an orientation of curiosity, experiential openness, and acceptance. This definition of mindfulness considers mindfulness as the self-regulation of attention as well as maintaining a nonjudgmental and accepting attitude towards events attended to. Self-regulation of attention is sustained through focus and consciously shifting attention between stimuli and observation of thoughts in a non-evaluative manner. The second part of the definition requires a person to intentionally and willingly experience current thoughts, feelings and sensations as they arise, and to accept these as a functional dimension of mindfulnessBased on this definition, Bishop et al. (2004) suggested that mindfulness is both a trait and state that can be developed over time and can lead to increased dispositional openness and acceptance, attentional capacity and reduction of experiential avoidance.

For the purpose of the current study, mindfulness will be defined as: "a process of regulating attention in order to bring a quality of non-elaborative awareness to current experience and a quality of relating to one's experience within an orientation of curiosity, experiential openness, and acceptance." (Bishop et al., 2004, p. 234).

Mindfulness is therefore more than just a state of present moment awareness and an 'eyes closed' meditative practice (Gardner & Moore, 2007). Mindfulness is a multifaceted process made up of core processes which include present moment awareness (Brown & Ryan, 2003), as well as the ability to defuse from internal experiences with attitude of openness and experiential acceptance (Bishop et al., 2004; Desbordes et al., 2014), all of which significantly correlate with a person's psychological wellbeing (Baer et al., 2008). Mindfulness in psychology considers the interplay of present moment awareness (Bishop et al., 2004), experiential acceptance (Wendling, 2012), defusion (Gardner & Moore, 2007) and self-compassion (Neff, 2003) when it comes to promoting adaptive responses in the context of difficult internal experiences and other stressors.

3. Meditation

It is important to distinguish between mindfulness and meditation as it is common for people to use both terms interchangeably (Shapiro et al., 2008). Mindfulness can be thought of as a state of consciousness involved in attending to and witnessing one's present moment experiences nonjudgmentally, "a kind of non-elaborative, nonjudgmental, present-centred awareness in which each thought, feeling or sensation that arises in the attentional field is acknowledged and accepted as it is." (Bishop et al., 2004, p. 232). Meditation can be thought of as "scaffolding used to develop the state or skill of mindfulness" (Shapiro et al., 2008, p. 374). As such, meditation is not mindfulness in itself, but a powerful technique that can be used to develop mindfulness (Bishop et al., 2004; Brown & Ryan, 2004).

There are many different ways a person can meditate. The most widely practiced meditation techniques include breathing meditation, loving kindness meditation and observing thoughts meditation. These are known as Witnessing Meditative techniques or Focused Attention Meditation, and require the direction of attention to be placed on either the breath, images, words of love and kindness, and observation of thoughts. Loving kindness and observing of thoughts meditative techniques are regarded as mental training techniques in that they train cognitive skills, such as sustained attention and working memory, and therefore require a level of perceived mental effort. Studies have indicated that these techniques are more challenging, less enjoyable and less relaxing due to the high perceived mental effort of observing and contemplating thoughts and loving-kindness (Lumma et al., 2015).

Opposite to Focused Attention Meditation is Open Monitoring Meditation where there is no object or event in the external or internal state that the meditator is required to focus on. During Open Monitoring Meditation attention is directed towards any experience that may arise while playing close attention to wherever the mind goes without judgement or reaction, while staying present to the experience. Focused Attention and Open Monitoring Meditation techniques in isolation can be very challenging for novice meditators and potentially frustrating (Lumma et al., 2015). As such, many popular meditation techniques involve a mixture of focused attention and open monitoring attention meditative techniques. For example, certain mindfulness meditations may involve focused attention on the breath or body parts, as well as open monitoring of distracting internal experiences that come up. During this type of meditation, a person is required to remain nonjudgmental and nonreactive of any thoughts and

feelings that may arise during the meditation while bringing their focused attention back to the breath or body part when their mind wonders (Riskin, 2002).

In the west, common types of meditation include Mindfulness Meditation (Cullen, 2011) and Transcendental Meditation (Travis & Parim, 2017). Mindfulness meditation focuses attention on the here and now in a nonjudgemental, non-evaluative way, without distorting present reality with thoughts and feelings. Examples of mindfulness meditation include Focused Attention Meditation techniques such as focusing attention on body parts, the breath or other senses (Cullen, 2011). Transcendental Meditation and Vedic Meditation require less effort. These techniques are classified as Self-Transcending Meditation (Travis & Shear, 2010) and use an effortless sound without meaning in the form of a mantra to trigger the mind to settle into quitter levels of thought until it achieves a state of consciousness where thought it not the centre of attention. Although deep, this type of meditation is a simple, effortless technique that allows the mind to effortlessly transcend into a state of restful alertness (Travis & Parim, 2017)

Travis and Shear (2010) classified meditation into three categories according to their electroencephalographic (EEG) signatures. Focused Attention Meditation produced gamma EEG waves. Gamma waves are associated with conscious attention and synchronise neural activity in response to stimuli (Desair et al., 2015). Opening Monitoring Meditation techniques produced theta EEG waves. Theta waves often occur when a repetitive task becomes automated, often requiring less focus. Achieving theta coherence during meditation can be challenging, especially for novice meditators (Lutz et al., 2009). Automatic Self-Transcending Meditation was associated with EEG alpha waves. Alpha coherence elicits the integration of distal cortical-neural areas of the brain necessary for motor, sensory and cognitive functioning and is characterised by restful alertness and moderate brain activity. Alpha coherence is correlated with decreased perceived pain, enhanced cognitive performance and increased perceived calmness (Desai et al., 2015). Alpha waves elicit the integration of distal cortical-neural areas of the brain necessary for motor, sensory and cognitive functioning. Alpha EEG coherence is inversely correlated with state and trait anxiety, and positively related to self-esteem, enhanced learning and creativity as well as moral reasoning (expanded awareness concerned with satisfying the needs of others) and peak performance, all of which are thought to be important for developing resilience (Travis & Shear, 2010).

The main difference between Transcendental Meditation and other techniques such as Focused Attention Meditation, is that focused attention meditation usually involves a level of concentration or contemplation which requires perceived mental effort and can be very challenging for a busy mind or novice meditators (Ribeiro et al., 2018). Transcendental Meditation is a more effortless technique that uses a Sanskrit word in the form of a mantra. Mantra in Sanskrit means 'mind vehicle' where 'manas' means 'mind or to think' and 'tra' means 'vehicle'. The mantra is repeated softly in the mind whereby the word becomes experienced as faint sound. The mantra becomes faint and almost non-existent while the mind transcends into deeper levels of consciousness. When thoughts enter the mind, the meditator gently brings their awareness back to the mantra. This can happen many times through the course of a twenty minute Vedic or Transcendental Meditation practice. This type of Automatic Self-Transcending and deep rest is what makes Transcendental Meditation a preferred meditation technique for many meditators.

Evidence has suggested benefits of Transcendental Meditation across a variety of constructs related to mental health (Orme-Johnson & Barnes, 2014) and performance (Hunrung et al., 2009). A meta-analysis of 14 randomised control trials with a number of populations including college students and high level corporate managers measured the effects of on Transcendental Meditation on trait anxiety. The analysis suggested that Transcendental Meditation practice was more effective than treatment as usual (e.g., attention control treatment such as CBT) and alternative treatment (e.g. progressive and simple relaxation techniques, psychotherapy, group therapy, relaxation techniques, Taoist meditative techniques), and that this effect was greatest for people with high anxiety (Orme-Johnson & Barnes, 2014).

Evidence has shown a direct link between Transcendental Meditation and the stress response whereby Transcendental Meditation has shown to help the body recover from stress by decreasing the effects of previous stressors to help a person cope better in response to new stressful situations (Travis et al., 2009). A reduction in physiological stress in response to Transcendental Meditation has been shown through a decrease in sympathetic nervous system activity, an increase parasympathetic nervous system activity (Travis, 2001) and greater EEG alpha coherence (Dillbeck & Orme-Johnson, 1987). These physiological changes in the autonomic nervous system reflect a decrease in physiological stress, which has associated with improved psychological functioning (Beauchaine, 2001).

One study compared non-meditators, short term and long term Transcendental Meditators on Brain Integration score. The Brian Integration Scale measures EEG coherence whereby higher scores represent greater brain coherence. High brain coherence shows that various parts of the brain cooperate, while alpha waves reflect restful alertness. Brain integration plays a role in guiding and generating goal directed behaviour and is correlated with more frequent peak experiences in top performers, greater emotional stability, moral reasoning and decreased anxiety (Harung et al., 2009) The results found that Transcendental Meditators had greater brain coherence than non-meditators (Travis et al. 2009). This study is particularly relevant to athletes as brain coherence is associated with several benefits to athlete performance.

Hurung et al. (2009) study showed that elite level athletes had greater brain coherence than non-elite athletes. The study compared elite and non-elite athletes' brain integration scores, speed of habituation to a loud noise, moral and self-development, and peak performance. Elite athletes showed significantly greater scores on the Brain Integration Scale, more rapid habituation and higher levels of self-development, moral reasoning and peak performance than non-elite athletes. The authors further suggested that a link between brain coherence and reported benefits. For example, frontal lobe brain coherence controls habituation stressful stimuli. Faster habituation promotes of a focus on task-relevant stimuli whereby athletes are less likely to be distracted by task-irrelevant stimuli – this is related to optimal performance. The authors concluded that that greater brain coherence may enhance habituation and self-development which helps athletes to say calm and focused in response to stressful competitive situations.

Although meditation practices can differ in their technique, they also share similarities when it comes to enhancing mindfulness. Baer et al., (2004) identified four mindfulness skills; namely, observing, describing, acting with awareness, and accepting without judgement. A three-month randomised controlled trial found these mindfulness skills to be a by product of Transcendental Meditation. The study found that those practising Transcendental Meditation reported significantly greater increases in mindfulness than participants in a waitlist group (Tanner et al., 2009). A study with zen practitioners found similar results. Zen meditation is an open monitoring type of meditation and relies on expanding one's attentional scope to experience the flow of thoughts, emotions and subjective awareness of ongoing physical and

self-referential processes. Brown and Ryan (2003) took a sample of zen practitioners and found that zen meditation practice was associated with the greater mindfulness traits identified by Baer et al., (2004) as key characteristics measured on the Mindfulness Attention Awareness Scale. Tanner et al. (2009) and Brown and Ryan (2003) demonstrated that mindfulness can be cultivated through different types of meditation practice.

Meditation has been integrated into many current popular and validated Acceptance and MBI's including Mindfulness Acceptance Commitment Therapy (Berneir et al., 2009), Mindfulness Based Stress Reduction (Birnie et al., 2010) and Mindfulness-Based Cognitive Behavioural Therapy (Cayoun et al., 2018). However, it is important to reiterate that meditation is just one way to achieve mindfulness. This is emphasised in ACT, a Mindfulness and Acceptance Based Intervention which recognises many ways of promoting mindfulness outside of formal meditation practice. ACT breaks mindfulness down into four psychological skills: defusion, acceptance, contact with the present moment, and self as context (observing the self where a person is not identified with thoughts and emotions), all of which can be achieved outside of formal meditation practice (Mahoney & Hanrahan, 2011). Nonetheless, studies (Lazar et al., 2005) have indicated that regular meditation practice leads to structural changes in the brain which promote functional changes in how a person responds to and experiences stress, suggesting mindfulness may benefit from meditation practice.

4. Mindfulness Based Interventions (MBIs)

a. Mindfulness-Based Stress Reduction

Mindfulness was first introduced into psychology in 1979 by John Kabat-Zinn (Kabat-Zinn, 2003) who developed Mindfulness-Based Stress Reduction to help relieve pain, illness and associated stress in medical patients. The main objective of Mindfulness-Based Stress Reduction is to promote the ability to pay attention and become aware of the present moment, while encompassing a nonjudgmental attitude, and encouraging acceptance and self-compassion towards oneself and one's experiences. Self-compassion is a key part of Mindfulness-Based Stress Reduction and involves kindness to oneself in the face of suffering, and recognising that discomfort is a natural part of the human condition (Birnie et al., 2010). Mindfulness-Based Stress Reduction is an 8-week course, with one 90-minute session per

week. The course is traditionally taught experientially through guided body scans and mindfulness meditations with mindfulness exercises integrated into daily life, as well as psychoeducation around mindfulness and group discussion related to personal challenges along the way (Birnie et al., 2010). Initially, Mindfulness-Based Stress Reduction was predominately used with clinical populations. It was not until 1985 that Kabat-Zinn conducted the first empirical test on Mindfulness-Based Stress Reduction with athletes using Olympic and collegiate rowing teams. Further, mindfulness has been shown to enhance athletes' receptiveness to traditional Psychological Skills Training and overall performance outcomes (Birer et al., 2012).

By the 1990's mindfulness had become a key part of training for some of the world's best basketball teams, including the National Basketball Association's (NBA) Chicago Bulls and LA Lakers. In 1993 Phil Jackson, coach of Chicago Bulls, introduced mindfulness training to help the team deal with performance pressure, promote team building and enhance focus during coaching, by using video playbacks. Jackson reported, "when players practice what is known as mindfulness - simply paying attention to what's happening - not only do they play better and win more, they also become more attuned with each other; the joy they experience working in harmony is a powerful motivating force that comes from deep within, not from some frenzied coach pacing along the side shouting obscenities." (Riskin, 2002, p. 8). Jackson led the Bulls to six NBA championships and soon after, led the LA Lakers to five NBA championships. The integration of mindfulness into top NBA team training regimes set the tone for making mindfulness more mainstream in sport and performance. Now, mindfulness is considered a guiding paradigm for the United States Olympic committee as a way of helping athletes train and cope with the inevitable stress that coincides competing at an Olympic level (Kaufman et al., 2009).

Studies on Mindfulness-Based Stress Reduction with athletes have surfaced over the last 10 years have and shown promising results. A randomised control trial with 14 injured university athletes assessed the effect of an eight-week Mindfulness-Based Stress Reduction course on pain tolerance, stress, and positive affect. Results showed an increase in pain tolerance and mindfulness over time, as well as a notable decrease in stress and anxiety self-report measures (Mohammed et al., 2018). A recently published randomised control trial with 40 male football players randomly assigned participants to either an eight-week Mindfulness-

Based Stress Reduction condition or control condition. Participants completed three sets of self-report measures over throughout the intervention. The Mindfulness-Based Stress Reduction group showed reductions in anxiety, depression and stress over time, as well as improved psychological well-being from baseline to intervention completion and post-intervention follow up measures (Norouzi et al., 2020). Another recent randomised control trial investigated the influence of Mindfulness-Based Stress Reduction on psychological the wellbeing, sleep, athletic coping skills, and rowing performance of collegiate rowers. In contrast to the control group, the intervention group showed improvements in psychological wellbeing, subjective and objective sleep quality, athletic coping skills, and rowing performance as measured by a 6000 metre ergometer test; such improvements correlated with increased mindfulness in the intervention group (Jones et al., 2020).

b. Acceptance Comittment Therapy (ACT)

As the first MBI be used with high performance athletes, Mindfulness Based Stress Reduction inspired the development of many mindfulness and acceptance-based interventions (Baer et al., 2019). Hayes (1986) developed ACT which uses mindfulness and acceptance strategies with behavioural change strategies to increase psychological flexibility.ACT is delivered over six modules focusing on acceptance (a willingness to experience internal events without defense), defusion (noticing thoughts and emotions as just thoughts and emotions, whereby a person is not defined by their thoughts and emotions) and present moment awareness (flexible attention to the present moment). ACT also includes modules related to self as context (viewing self as the experience of thoughts and feelings rather than identifying with the content of thoughts as feelings, values (clarify personal values which act to guide behaviour) and committed action (clarifying personal values and connecting them to action). ACT encourages a person to observe and accept internal thoughts, feelings and sensations as they arise without attempting to avoid or change them in order to achieve psychological flexibility (Ciarrochi et al., 2010).

Mechanisms of mindfulness that foster a person's psychological flexibility through ACT include an awareness of internal experiences and attention towards observing and then defusing from thoughts and emotions that may otherwise prevent a person from behaving in a way that is in line with their values. Self as context is also fostered through mindfulness

exercises through labelling and defusing difficult thoughts, such as metaphors and experiential processes encouraging observation of thoughts and emotions. In this sense, present moment awareness of internal experiences is a precursor to accepting internal experiences and gaining a perspective of self as context, both of which elicit committed action to values-driven behaviour. It is important to point out that a although large part of ACT involves mindfulness, ACT also incorporates behavioural based approaches by helping a person consistently choose to act effectively in the presence of difficult internal experiences (Blackledge, 2007).

Research has shown ACT to be effective in the treatment of anxiety (Roemer & Orsillo, 2002; Eifert & Forsyth, 2005), depression (Hofmann et al., 2010; Karlin et al., 2013), psychosis (Morris et al., 2013), addiction (Luoma et al., 2008) and even weight loss (Tapper et al., 2009). Few studies have applied ACT interventions athlete populations as the Mindfulness Acceptance Commitment Therapy was developed from ACT and is targeted towards athletes and human performance (Henrikson et al., 2019; Gardner, 2009). One case study examined four injured athletes during their rehabilitation from ACT knee injuries to explore the usefulness of an adapted ACT intervention in addressing their adherence to rehabilitation protocols and their psychological well-being (Mahoney et al., 2011). Injuries are one of the leading causes of stress for many high-performance athletes (Evans et al., 2012). The adapted ACT Therapy based intervention educated injured athletes on how to meet the challenges of their recovery, and how to commit to their rehabilitation and exhibit behaviours that would aid their return to sport. Injured athletes are likely to avoid difficult thoughts and emotions following their injury while engaging in maladaptive emotion-driven behaviours. Participants in the ACT intervention reported specific skills such a cognitive defusion and mindfulness as useful when accepting difficult emotions for promoting values-driven behaviours and adhering to rehabilitation protocols.

Bernier et al. (2009) conducted a longitudinal single case research study to examine the effectiveness of a sport adapted version of ACT for young, elite golfers over four months. The program included ACT modules which included in session and at home meditation practice. The results indicated that after one year of competition, all seven golfers who underwent the ACT program improved their national ranking. Improved performance was reported as improved efficacy of their routines by seeking more relevant internal and external information rather than focusing on internal processes. In comparison, only two of the six

golfers in the control condition increased their ranking, further suggesting the effectiveness of ACT in enhancing athlete performance. It is important to make note of Bernier's et al. (2009) small sample size and long time frame between the testing period pre and post intervention as there may have been a number of other variables within that year that could have improved athlete performance.

ACT works by helping athletes switch their attention from internal states to the relevant task at hand for enhanced performance through mechanisms of mindfulness and other behavourial strategies related to values-driven behaviour (Bernier et al., 2009; Mahoney & Hanrahan, 2011). Through increased mindfulness, awareness, acceptance, self as context and defusion, athletes become more psychologically flexible, and are more likely to willingly experience a spectrum of thoughts and emotions without becoming distracted by them (Bernier et al., 2009). ACT allows internal experience to exist while focusing on the task at hand, and for behaviour in the direction of values in response to task relevant cues, both of which may aid optimal performance. On the contrary, when athletes behaviours serve to temporarily minimise personal discomfort through experiential avoidance, they may become overly focused on internal experiences rather than on values and task relevant demands of the sport. Avoidance of internal experiences may result in psychological inflexibility which has the potential to impair performance and increase negative affect (Henrikson et al., 2019). More research is needed to understand the benefits of ACT with athletes. Research applying Mindfulness Acceptance Commitment Therapy with athletes has demonstrated that ACT modules in combination with mindfulness training can be helpful to athletes.

c. Mindfulness Acceptance Commitment Therapy

ACT has played a key role in the development of Mindfulness Acceptance Commitment Therapy which was developed for human performance as a mindfulness and acceptance based behavioural intervention for athletes. Mindfulness Acceptance Commitment Therapy has since been conceptualised as a broader approach to performance enhancement (Henrikson et al., 2019) and consists of seven modules inspired by ACT. Modules are delivered over seven or more weeks through a sequential process of practitioner to client discussion, in session exercises, and between-session activities to develop greater present moment awareness and to increase tolerance to negative thoughts, emotions, and physical sensations through

enhanced experiential acceptance (Mahammed et al., 2018). The seven modules include mindfulness psycho education, mindfulness and cognitive defusion, values and values-driven behaviour, acceptance of unpleasant internal expereinces, enhancing commitment to behaviours consistent with performance values, skills consolidation, and maintaining and enhancing practice of these skills (Gross et al., 2018, p. 436). The main goal of Mindfulness Acceptance Commitment Therapy is to exert control over private internal experiences such as thoughts, emotions, and physiological sensations through enhanced regulation of attention, and to poise for optimal performance. Attention is defined as "the capacity to pay attention to task relevant information as needed" (Garnder & Moore, 2007, p 139). Poise is defined as "the ability to act in the service of values and goals despite negative internal states such as thoughts, emotions, and physical sensations that the client may be experiencing." (Gardner & Moore, 2007, p. 139).

Since the development of Mindfulness Acceptance Commitment Therapy in 2001, several studies have surfaced supporting its efficacy in enhancing athlete wellbeing and performance. Dehghani et al. (2018) conducted a randomised clinical trial with 31 university athletes to determine the effectiveness of Mindfulness Acceptance Commitment Therapy on athlete performance and competition anxiety. Results showed that Mindfulness Acceptance Commitment Therapy significantly increased basketball performance while significant decreases were found on self-report measures of experiential avoidance and anxiety. Gross et al. (2018) ran an open trial study of a Mindfulness Acceptance Commitment Therapy course with eleven NCAA Division I (elite level) female volleyball and field hockey athletes. The results suggested that Mindfulness Acceptance Commitment Therapy led to a greater athletic performance including task-focused attention and practice intensity, improvements in dispositional mindfulness and emotional distress, as well decreased psychological inflexibility compared to the control PST group. Schwanhausser (2009) further demonstrated the effectiveness of Mindfulness Acceptance Committment Therapy through a case study with an adolescent competitive springboard diver. The results indicated an increase in self-report measures for mindful awareness, mindful attention, experiential acceptance, flow state, and diving performance from pre to post intervention. Interestingly, the participant showed no significant improvement in anxiety over time. The authors concluded that the participant's ability to tolerate and not fear or attempt to avoid stress and anxiety may explain why there were no improvements in anxiety. This is not a surprising finding when considering that the

aim of mindfulness is not to eliminate difficult internal experience but rather to become aware of, accept and defuse from difficult internal experiences while remaining focused on the task at hand (Gross et al., 2018).

A more recent study by Josefsson et al.,(2019) randomly assigned 69 competitive elite athletes with no prior experience of mindfulness practice into either a Mindfulness Acceptance Commitment Therapy group or a traditional PST group. Findings indicated that the Mindfulness Acceptance Commitment Therapy intervention had an indirect effect on self-rated athletic training performance through changes in dispositional mindfulness and emotion regulation. The Mindfulness Acceptance Commitment Therapy group showed greater posttest improvements in mindfulness, emotion regulation, and perceived performance compared to the PST group. Although this study did not directly measure changes in stress, the authors suggested that improvements in mindfulness reduce emotional reactivity and can improve performance on cognitive tasks in emotionally triggering situations. These studies have highlighted the importance of developing mindfulness in athletes who are expected to perform optimally under what can be very challenging and stressful conditions (Birrer & Morgan 2010).

Josefsson's et al. (2019) study is in line with past research which demonstrated the effectiveness of Mindfulness Acceptance Commitment Therapy intervention over PST. Hasker (2010) compared the effectiveness of PST intervention which including imagery, goal-setting, positive self-talk, relaxation, and arousal control to a Mindfulness Acceptance Commitment Therapy intervention that included eight week Mindfulness Acceptance Commitment Therapy program with a focus on mindfulness, acceptance and commitment to values with NCAA division I athletes. The results indicated a significant increase in athletes' capacity to describe and be nonreactive to their internal states, as well as an increase in experiential acceptance, and greater commitment to behaviours aimed at achieving athletic values and goals in the Mindfulness Acceptance Commitment Therapy group compared to the PST group. Other studies have shown Mindfulness Acceptance Commitment Therapy to reduce stress. An open trial with an entire NCAA Division I men's athletic team received eight 90 minute group sessions based on a Mindfulness Acceptance Commitment Therapy program, with each session immediately followed by a one hour Hatha yoga session. When compared with a control condition, Mindfulness Acceptance Commitment Therapy participants reported significantly enhanced mindfulness, task-focused attention and less perceived stress (Goodman et al., 2014).

d. Mindfulness Based Cognitive Behavioral Therapy

Other successful MBIs used with clinical and performance populations include Mindfulness Based Cognitive Behavioural Therapy (Cayuon, 2018). Mindfulness Based Cognitive Behavioral Therapy is a four stage therapeutic approach combining evidence based mindfulness techniques with principles of CBT to address a broad range of psychological disorders and other stress related conditions. The stages are designed to develop mindfulness, cognitive and behavioural skill sets. In stage one, mindfulness meditation training is used to internalise attention in a way that decreases emotional reactivity and promotes deep levels of awareness and experiential acceptance. Stage two focuses on attention being directed outward to regulate behaviour by applying stage one skills in the context of avoidance. Stage three of Mindfulness Based Cognitive Behavioral Therapy focuses on dividing the focus of attention between self and others. Stage four extends stage three skills to promote more global awareness of how a person can overcome unnecessary suffering and help others overcome suffering. In this approach, mindfulness is considered a primary prerequisite skill to the additional three stages of the intervention (Cayoun, 2011).

Mindfulness Based Cognitive Behavioral Therapy has been shown to be effective in clinical settings, including with the treatment of Post Traumatic Stress Disorder, addiction, pain (Cayoun et al., 2018), depression, and anxiety (Yazdanimehr et al., 2016). There have been few studies published using Mindfulness Based Cognitive Behavioral Therapy with athletes. One promising study suggested that participation in the Mindfulness Based Cognitive Behavioral Therapy program increased participant mindfulness and flow state, and decreased pessimism and anxiety (Scott-Hamilton & Schutte, 2016). This study highlighted the importance of frequency, accuracy, duration, and adherence to Mindfulness Based Cognitive Behavioral Therapy. Records of participant adherence suggested that athletes who were less committed to at inter-session mindfulness practice reported fewer benefits than those who were more committed. This is important to consider because many of the existing MBIs rely on lengthy and time -consuming training commitments, which can deter less motivated participants from fully participating in and benefiting from Mindfulness Based Interventions (Wilson et al., 2017; Burton et al., 2016). To overcome this limitation and add to convenience and accessibility to MBIs, future research may benefit from taking into account athletes' busy schedules by offering MBIs that are less time consuming and more accessible.

5. Psychological Skills Training with Athletes

To better understand the benefits of mindfulness in the context of high performance sport, it is important to consider the role of PST as one of the most popular approaches used to develop mental skills with athletes. PST is defined as "the systematic and consistent practice of psychological skills in the pursuit of high performance" (Weinberg & Gould, 2014, p. 248), and is characterised by "any actions or processes that alter functioning and/or performance through changes in an individual's thought and behaviour." (Zahkrajsek & Blanton, 2017, p. 7). PST focusses on helping individuals self regulate their behaviour through a shift in mindset, and is delivered through several methods including imagery, visualisation, positive self talk, goal setting, arousal control and mental rehearsal (Birrer & Morgan, 2010). PST is predominately focused on enhancing athlete performance (Weinberd & Gould, 2014) while MBIs focus on enhancing both athlete performance while considering wellbeing factors present outside of performance (Gardner & Moore, 2006). This is an important point of difference because studies have shown a relationship between athlete wellbeing and performance, where athletes' wellbeing outside of sport effects their ability to perform during sport (Dunn, 2014). PST is therefore limited in that it fails to consider an important cause of poor performance: athlete stress and wellbeing outside of sport (Dunn, 2014). MBIs take a more holistic approach, and may explain why these interventions may be more helpful to athletes, especially athletes suffering from stress (Gardner & Moore, 2006; Hasker, 2010).

PST Training uses cognitive behavioural methods based on the assumption that negative internal experiences interfere with performance and must be regulated to promote positive thinking and self confidence (Zakrajsek & Blanton, 2017). Due to the commonly held belief that low levels of stress and anxiety, less negative thinking, and high levels of self confidence in athletes leads to greater performance (Gould et al., 1981), psychology for athletes has typically focused on eliminating or controlling unwanted internal states for optimal performance (Hasker, 2010).

Imagery promotes athletes' use of their senses to recreate or create an experience in the mind. Imagery is the most widely studied technique in PST literature, as well as the most popular mental skills technique delivered to athletes (Zakrajsek & Blanton, 2017). Over recent years PST has been criticised for its lack of credible research; over a 20 year period, only seven

studies had evaluated the efficacy of imagery interventions with actual performers (Rumbold et al., 2012). There has also been debate as to how helpful traditional PST techniques are when it comes to enhancing athlete performance (Birrer et al., 2012; Birrer et al., 2010; Gardner & Moore, 2006) and wellbeing (Luoma et al., 2008; Wenzlaff & Wegner, 2000). A largescale qualitative review of the empirical literature on PST for the enhancement of competitive athletic performance demonstrated insufficient evidence for its efficacy. Studies were reviewed according to the established criteria for empirically supported treatments developed by the Committee of Science and Practice (under Division 12 of the American Psychological Association; Chambless & Hollon, 1998; Gardner & Moore, 2006). The review revealed that, out of the studies that met the criteria, none of them demonstrated empirical support for the use of goal setting, imagery, arousal control, or self talk modification for performance enhancement. Although findings suggested slightly better efficacy for multicomponent (combined procedure) interventions, the findings were inconsistent. It was concluded that traditional PST for athlete performance enhancement failed to demonstrate sufficient efficacy, and that more robust research on the effects of PST with athletes was needed (Gardner et al., 2006).

Explanations against PST have suggested that a desire to control thoughts through PST techniques, such as that of self talk, may make suppression of, or distractions from, thoughts more of a risk (Wegner et al., 1993). For example, thought distraction or thought suppression may result in a rebound effect where there is an increased intensity of the unwanted thought (Wenzlaff & Wegner, 2000). It has been suggested that PST may trigger a metacognitive scanning process, where excessive cognitive activity and task irrelevant focus (i.e. internal focused attention through trying to change thoughts and mental images) may disrupt performance (Aherne et al., 2011).

Such concerns are supported by The Theory of Ironic Processes of Mental Control (Wegner, 1994; Janelle, 1999) and Reinvestment Theory (Masters & Maxwell, 2008). This theory suggests that humans tend to feel, act, and think in ways that are opposite to the intended direction of emotion, behaviour, and cognition, and that this effect is particularly prevalent when a person is under stress (Josefsson et al., 2019). For example, stress increases cognitive load where the likelihood of effective self regulation is reduced. Occasional failure of mental control with athletes may be due to load inducing circumstances associated with the stress of

high performance sport. According to the Theory of Ironic Mental Processes of Mental Control, even when individuals are consciously trying to focus on desired outcomes, high stress will likely result in an automatic shift in attention towards signs of failure which may result in undesired outcomes (Janelle, 1999).

The detrimental effects of Ironic Thought Processes have been shown across multiple studies. Binsch et al. (2009) examined 32 male intermediate football players taking penalties in a simulated penalty environment with and without instructions to avoid the goalkeeper. The study aimed to find out whether ironic effects in scoring a goal were accompanied by fixations on the target. Findings from this study demonstrated that ironic effects were preceded by longer fixations on the 'to be avoided 'area (i.e., focusing on avoiding the goalkeeper), further supporting the detrimental effects of over-fixating on undesired outcomes during high pressure situations. Binsch's et al. (2009) with golf players found similar results whereby players who fixated on what not to do, were more likely to perform poorly.

Other studies have shown how Ironic Thought Processes can also harm a person's wellbeing. In many cases, and especially when a person is already under stress, mental control may not only fail to achieve desired states of mind but can ironically create the most undesired state. For example, trying to be happy or trying not to be sad can make a person sadder and trying to be relaxed can make a person anxious (Wegner, 1994). Wilson et al. (2014) found that people suffering from anxiety disorder demonstrated relaxation induced anxiety or relaxation induced panic when they attempted to reduce anxiety through relaxation. Other studies have demonstrated the detrimental effects of Ironic Thought Processes under stressful conditions. Wegner et al. (1993) showed that participants who attempted to control their mood without an imposed cognitive load were successful at regulating their emotions. However, those who attempted to control their mood while mentally rehearsing a nine-digit number failed to control their mood; self-reported mood changes were opposite to the mood changes they intended to create. It was concluded that attempting to control mood related thoughts under cognitive load induced stress led to increased accessibility to those thoughts, thus opposing the direction of intended control. The above studies indicated that the intention to avoid or control an action or particular thought may increase the tendency to engage in the actions or thought (ironic effects), or cause an undesirable increase in the opposing action through over-

compensation (Binsch et al., 2009; Wilson et al., 2014), and that these effects are more likely to occur in high stress situations (Wegner et al., 1993).

Ironic Thought Process and The Theory of Reinvestment are similar in that they both demonstrate the detriments of excessive thought control (Wegner et al., 1993; Masters & Maxwell, 2008). The Theory of Reinvestment differs from Ironic Thought Process in that it is more specific to sport performance and motor skills, suggesting that implicit skills (skills executed automatically without conscious effort) become impaired when a person attempts to control implicit skills with declarative knowledge (skills executed through conscious effort) (Masters & Maxwell, 2008). Similar to Ironic Thought Processes, Reinvestment is due to self-evaluations driven by an attempt to control internal states, personal goals and desired outcomes, which is the essence of many PST techniques (Gross et al., 2018). Studies have evaluated the detrimental effects of Reinvestment with athlete populations. Beilock et al. (2001) investigated the impact of suppressive imagery on golf performance with 126 novice golf players. Results suggested that frequent application of suppressive imagery impaired performance and attempts to replace negative images with corrective ones did not improve the damage caused by negative images. Beilock et al. (2001) conducted a second study to explore impact of attention on sensorimotor skills. Two separate groups of novice and expert soccer players were asked to dribble a soccer ball under different task focused conditions. Results showed that the performance of experienced players was worse when their attention was drawn to their dribbling movements triggered by instructions to bring awareness to which side of the foot had last touched the ball. This effect was not observed in novice players. These results suggested that automated components of performance can be compromised by attending to the process of skill execution. Further, athletes experiencing high stress are more likely to focus on implicit skills, making Reinvestment more of a risk for stressed athletes (Masters, 1992).

There is evidence to suggest that mindfulness and acceptance-based approaches may be an effective way of managing unwanted or negative thoughts and emotions without the need of trying to eliminate or control them. Levin et al. (2012) conducted a meta-analysis of 66 laboratory based component studies that evaluated treatment elements and processes underlying ACT and CBT. The results revealed that contextual strategies such as those used in ACT through processes of mindfulness, including present moment awareness, experiential acceptance and defusion, may lead to longer lasting behavioural changes compared to strategies

that directly target the content of thoughts and feelings in CBT. Mindfulness may also mitigate the effects of Ironic Mental Processes and Reinvestment through enhanced attentional control (Birrer et al., 2012). Popular MBIs such Mindfulness Acceptance Commitment Therapy helps athletes defuse their attention from internal processes, and focus on task relevant stimuli, thus making actions in the service of performance goals and values more accessible (Josefsson et al., 2019).

Attentional control that becomes excessive characterised by over attentiveness to extrinsic task relevent stimuli, may increase the occurrence of Reinvestment (Masters & Maxwell, 2008) and Ironic Thought Processes (Janelle, 1999). Therefore, there is a fine line between optimal attentional control through mindfulness and over attentiveness. In the context of Reinvestment, attentional control can be classified into explicitly monitoring a movement and consciously controlling a movement. It has been suggested that task relevant monitoring can occur without conscious control and that being able to monitor skills rather than consciously control them is associated with optimal performance and flow state (Jackson et al., 2006). Mindfulness may help athletes better monitor (rather than control) task relevant skills without the need to overly control distracting thoughts and emotions. For example, a Mindfulness Acceptance Commitment approach is based on the premise that optimal performance is influenced by an athlete's ability to remain nonjudgmentally aware of internal experiences while at the same time focusing attention on present moment task relevant cues despite possible internal discomfort (Gross et al., 2018).

PST focuses more on performance than wellbeing (Weinberd & Gould, 2014), while MBIs consider athlete wellbeing as an important factor to consider when enhancing athlete performance (Dunn, 2014). Meta analyses revealing insufficient evidence supporting the use of PST for enhancing athlete performance (Chambless & Hollon, 1998; Gardner & Moore, 2006) has suggested a need for further exploration into the effectiveness of other approaches, such as MBIs (Gardner & Moore, 2006). Evidence from the theories of Ironic Thought Processes (Janelle, 1999) and Reinvestment (Masters & Maxwell, 2008) has demonstrated why PST techniques such as self-talk (Wegner et al., 1993) and imagery (Beilock et al., 2001) may not be helpful to athletes, and further suggests control based approaches make unwanted internal experiences (Wilson et al., 2014; Binsch et al., 2009; Wilson et al., 2014) and performance outcomes worse (Beilock et al., 2001; Binsch et al., 2009). It is therefore

important for research to consider alternative approaches when it comes to helping high performance athletes.

6. Limitations of Mindfulness

Mindfulness has become popular in the field of psychology and self-help industries, making its way into the workplace, schools and sports for enhancing wellbeing and performance (Hyland, Lee, & Mills 2015; Park, 2020; Yeung & Lun, 2020). However, there are minimal regulations when it comes to teaching mindfulness. On one hand, this makes mindfulness accessible to a wide range of people as it is commonly taught by yoga and meditation teachers, coaches and even school teachers (Hyland, 2017). On the other hand, a lack of regulated mindfulness training may have negative consequences. In an article, 'The Challenges of Certifying Mindfulness Teachers' by Jaret et al. (2019), the author referred to an open letter to the International Mindfulness Teachers Association (IMTA) stating that "the mindfulness movement is in danger of ignoring the essential quality of a good teacher, with wisdom in favour of a set number of prerequisites and course hours" - (Jaret, Hutton, Maldonado, Kuyken, Hunter, & Newman, 2019). The article by Jaret et al. (2019) highlighted a need for transparent systems for the general public to discriminate between those who have undertaken rigorous course training and those who have not.

The need for better regulation in mindfulness teaching has been demonstrated in research that has shown there are potential detriments experienced by those practicing meditation (Baer et al., 2019). Little is known about the potential harm associated with meditation; however, the few studies that have been conducted deserve recognition. An online survey of 342 meditation practitioners found that 25.4% of meditation teachers reported unwanted effects of meditation, including negative emotions, pain, depersonalisation and other symptoms with students (Cebolla et al., 2017). Similar findings in case studies were found to be related to individuals who had attended intensive meditation retreats (Baer et al., 2019). However, three out of the four studies reviewed by Baer et al. (2019) suggested that many participants described these negative experiences as temporary and useful in developing skills and insights.

One possible explanation for temporary negative side effects reported by meditators may be the result of the deliverance of a non-evidence based mindfulness intervention. The interventions in the four studies reviewed were Transcendental Meditation delivered by a meditation teachers at Meditation International Society, Vipassana meditation delivered at an intensive 'silent' Vipassana meditation retreat by meditation teachers mixed mindfulness meditation where the source of learning was not recorded and mixed mindfulness meditation delivered as part of a clinical or nonclinical intervention (Baer et al., 2019).

The integration of evidence-based psychoeducation in the above interventions may have reduced negative affect during meditation by educating participants on the role of acceptance of internal experiences and knowledge related to self as context. This is when a person learns that through observation and acceptance of internal experiences, that they are separate from those internal experiences (Castonguay & Beutler, 2006). Psychoeducation is common in many evidence-based mindfulness interventions (Josefsson et al., 2019; Kaufman et al., 2005; Scott-Hamilton & Schutte, 2016), and may help to mitigate negative consequences related to misinformation, unrealistic expectations, and participants' inability to safely manage and grow from the discomfort that will often accompany regular meditation (Baer et al., 2019).

People often incorrectly associate mindfulness and meditation as a means of relaxation and positive thinking, or clearing the mind of all thoughts (Gross et al., 2018; Baltzell et al., 2014). Relaxation is considered a secondary benefit of Mindfulness Acceptance Commitment Therapy, rather than the primary outcome (Gardner, 2009). The focus on allowing thoughts to exist without the need to eliminate or control them is taught in the Mindfulness Acceptance Commitment Therapies psychoeducation module. This reinforces the notion that mindfulness is used to "enhance self-awareness and the subsequent capacity to notice and be free from habitual reactions.", and to "pay attention to one's thoughts as objects of attention." (Gardner & Moore, 2007, p. 79), rather than to control or minimise unwanted internal experiences. Misunderstandings of mindfulness and meditation, like the idea of 'quietening the mind' may strip the practice of its real evolutionary potential, especially if people go into meditation with unrealistic expectations of stopping or controlling thoughts (Gross et al., 2018). Participants' unrealistic expectations about the meditation interventions, reviewed by Baer et al. (2019), may have contributed to reports of negative affect in those participating in meditation.

Reports of temporary negative affect related to meditation (Baer et al., 2019; Cebolla et al., 2017) are worth considering. This affect may be due to a lack of the delivery of evidence-based psychoeducation to participants. Without psychoeducation, inevitable discomfort that surfaces from meditation may cause negative affect and suffering (Baer et al., 2019; Gardner, 2009). It is therefore important to consider if there is a potential for harm when practicing mindfulness and meditation without the deliverance of psychoeducation. Further research should consider the importance of psychoeducation when applying meditation interventions.

7. Mindfulness and Stress

Mindfulness is becoming a popular intervention to successfully help athletes deal with stress (Bernier et al., 2014) as well as to enhance performance (Kaufman et al., 2018; Birrer et al., 2012; Bernier et al., 2018). Mindfulness is thought to reduce perceived stress through several mechanisms of change. For example, Mindfulness-Based Cognitive Behavioural Therapy targets cognitive reactivation where taught mindfulness skills promote self-awareness of distressing thoughts and feelings, experiential acceptance (willingness to experience internal events without defense), self-compassion in the face of distressing experiences, and the application of coping mechanisms aimed to reduced perceived stress and enhance adaption (Gu et al., 2018) Greater present moment awareness, acceptance and self-compassion are important mechanisms of change between mindfulness and perceived stress (Kuyken et al., 2018). According to the Transactional Model of Stress and Coping, stress emerges from appraising a potentially stressful event to be negative and exceeding a person's ability to cope (Eatough, 2015). Mindfulness can influence a person's appraisal of stress and how coping skills and self-regulation are applied in response to stress. These come about through promoting a nonjudgmental and accepting perspective of one's environment, and present moment awareness. Individuals attending to the present moment from a place of experiential acceptance may be able to perceive stressful events more objectively and are able to refrain from attaching personal significance to such events. This can lead to more adaptive appraisals whereby a person is less likely to perceive a stressful situation as a threat that exceeds their ability to cope (Wendling, 2012).

There is evidence to support the relationship between mindfulness, present moment awareness and perceived stress. Research has demonstrated that present moment awareness

as a general disposition measured by the Mindfulness Attention Awareness Scale (MAAS) is linked to many psychological benefits including reduced anxiety and depression, positive affect, increased wellbeing and lowered perceived stress (Brown et al., 2007; Weinstein, Brown, & Ryan, 2009). Present moment awareness is a key component of mindfulness (Brown & Ryan, 2003). Evidence has suggested that greater present moment awareness leads to more adaptive coping mechanisms when under stress (Donald et al., 2016). Weinstein et al., (2009) showed that participants reporting momentary levels of present moment awareness throughout the day demonstrated less avoidance coping in response to stress, measured at the end of each day over a seven-day period. These findings suggested that mindfulness, through present moment awareness, reduced avoidance coping. A reduction in avoidance coping mediated the relationship between mindfulness and wellbeing.

Reduced avoidance coping may also reduce stress, as avoidance coping is linked to greater levels of stress. A systematic review of sport literature related to coping found that avoidance coping was associated with greater psychological distress and reduced well-being in athletes (Nicholls & Polman, 2007). Dehghani et al., (2018) conducted a randomised clinical trial with basketball players and found that athletes participating in a Mindfulness Acceptance Commitment intervention program demonstrated less experiential avoidance, a significant decrease performance anxiety and an increase in performance. The effect size for the difference between the mindfulness and control group was moderate. These studies are indicative of a relationship between present moment awareness, mindfulness and more adaptive responses to stressors that may otherwise result in anxiety (Nicholls & Polman, 2007; Dehghani et al., 2018) .

Present moment awareness enhances a person's ability to respond to stress in a way that aligns with their values, rather than resorting to heat of the moment automatic emotion-driven behaviour (Hayes et al., 2006; Weinstein & Ryan, 2011). This has been demonstrated in research that suggested present moment awareness predicts greater momentary autonomy, which is indicative of values driven behaviour (Ryan & Deci, 2000). Multiple studies have further demonstrated a relationship between mindfulness, present moment awareness and values driven behaviour, where values driven behaviour elicited through mindfulness facilitates enhanced wellbeing and reduces psychological distress (Ciarrochi et al., 2011; Ferssizidis et al., 2010)

Other studies have shown how the relationship between present moment awareness and stress can be moderated by stress appraisal. Individuals who perceive stress as a threat are more likely to enact avoidance coping in response to stress (Park et al., 2004; Stowell et al., 2001). Donald et al., (2016) demonstrated a relationship between present moment awareness, threat appraisal and stress response in 143 undergraduate and postgraduate students. The results showed that present moment awareness resulted in adaptive stress responses independent of the participants' affective state and severity of perceived threat. However, this was only true for across days, not within days. This finding demonstrated that in the context of future responses to similar stressors, present moment awareness in the face of a stressor may be more helpful that investing energy into the reappraisal of stress from threat to challenge, or by seeking to control or inhibit emotions. This is in line with many MBIs which suggest that a person's experience of stress is influenced by how a person relates to stress eliciting internal experiences, rather than by the content and frequency of internal experiences (Gardner & Moore, 2007; Gross et al., 2018). This is consistent with the theory of self-determination which states that adaptive behaviours and choices are motivated by personal growth tendencies and innate psychological needs. In the context of mindfulness and self-determination, present moment awareness may predict greater self-regulation and coping in the face of distress, in order to grow and meet psychological needs (Ryan & Deci, 2000; Weinstein & Ryan, 2011).

Mechanisms of mindfulness also influence perceived levels of stress through reduced automaticity of mental processes. When it comes to appraising new stressful situations, a person's experience and behaviour when under stress can reflect automatic mental schemas based on past experiences. A mental schema is described as a cognitive structure that serves as an internal rule system for a person's knowledge about themselves and the world around them (Schwanhausser, 2009). Individuals who are more mindful in their appraisal of stress are less likely to automatically react in response to mental schemas, and are more likely to show greater accuracy in their primary appraisal of a stressful situation (Glomb et al., 2011). Mental schemas also play an important role in the relationship between athlete stress and performance. This is demonstrated in Gardner and Moore's (2006) Integrated Model of Athletic Performance which suggested three phases of athletic performance—the preparatory phase, performance phase, and post-performance phase. The performance phase is most crucial and concerns self-regulatory processes of athletic performance where there is an interaction between an athlete's

thoughts, emotions and behavioural responses due to developed schemas and external events. During this phase of performance, athletes are inclined to self-monitor while adjusting to meet performance standards. Performance standards are shaped by developed schemas relative to performance history and current expectations. This adjustment can lead to functional or dysfunctional performance depending on the interaction of instrumental competencies (i.e., athletic skill level), environmental stimuli (i.e., potential stressors), performance demands, behavioural self-regulation and dispositional characteristics (i.e., mental schemas) (Gardner & Moore, 2006). In the context of the Integrated Model of Athletic Performance, the benefits of mindfulness on self-regulation during the phases of athletic performance are twofold. First, mindfulness can influence how a person appraises stress, experiences stress and performs under stress by allowing "an individual to disengage from automatic thought patterns, engrained brain states, emotional filters, and cognitive schemas, and experience what is instead of a commentary or story about what is" - (Hyland et al., 2015, p. 581). Second, mindfulness helps individuals shift the appraisal of a stressful situation where challenges can be used to prime a positive state of eustress whereby "individuals experiencing eustress describe the experience as being focused in a mindful state of challenge, a healthy state of aroused attention on the task, exhilaration, and being fully present." (Hargrove et al., 2013, p. 61). This experience of eustress is also associated with optimal performance and self-reports of flow state in athletes (Jackson & Marsh, 1996).

Mindfulness may also affect a person's coping skills when it comes to managing a stressor post appraisal (Wendling, 2012). For example, mindfulness improves a person's ability to cope with stress through the promotion of personal resources. The Conservation of Resources Theory is a stress theory that suggests personal resources buffer against stress and enhance resiliency. The Conservation of Resources Theory is based on the principles of primacy of resource loss and resource investment, which suggests that individuals with more resources are more likely gain further resources, whilst those lower in resources are more likely to experience resource loss (Halbesleben et al., 2014). Personal resources promoted through mindfulness, such as enhanced self-compassion, self-efficacy and self-control, can buffer negative effects of stress (Hobfall, 1989). Further, mindful individuals are more likely to choose adaptive coping skills because they are less prone to negative cognitive processes linked to rumination or catastrophising (Weinstein et al., 2009). Finally, mindfulness influences a person's ability to self-regulate their emotions, thoughts and behaviours when under stress by

helping to build and sustain self-regulatory processes post stressor; thus resulting in enhanced emotional and behavioural self-regulation post stressor (Baumeister et al., 1998).

Systematic reviews and meta-analyses have shown that mindfulness training can significantly improve psychological outcomes including reductions in perceived stress, anxiety and depression (Goyal, Singh, Sibinga, Gould, Rowland-Seymour, Sharma, & Ranasinghe, 2014; Khoury, Fortin, Masse, Therien, Bouchard, & Hofmann 2013; Sedlmeier, Schwarz, Zimmermann, Haarig, Jaeger, & Kunze, 2012). A meta-analysis and systematic review by Goyal et al. (2014) analysed and reviewed 47 randomised clinical trials investigating the role of mindfulness meditation programs. The findings demonstrated moderate evidence for the role of mindfulness meditation programs in decreasing anxiety, and evidence for a relationship between mindfulness meditation programs and stress; however, this evidence was considered insignificant. It is important to note that the reviewed studies were with populations with mental or physical health problems. Further, many of the reviewed interventions ran for less than eight weeks. Longer term trials may show greater improvements in stress as the benefits of meditation are usually observed through regular practice over time (Goyal et al., 2014). The need for longer interventions and more consistent meditation practice may be especially relevant for athlete populations, as evidence has suggested that long term meditators demonstrate greater benefits than non-meditators and that long term meditation practice changes the brain structurally and functionally (Lazar, et al., 2005; Hernández et al., 2016; Vettesse et al., 2009). These benefits are associated with enhanced dispositional mindfulness (Hölzel et al., 2011) and emotional regulation (Lykins & Baer, 2009; Taren et al., 2013). An additional meta-analysis by Khoury et al. (2013) evaluated the efficacy of 209 mindfulness-based programs. The results suggested that mindfulness is an effective treatment for a variety of psychological problems, and is especially effective for reducing anxiety, depression, and stress.

The potential role of stress and affect in the mindfulness burnout relationship has suggested that mindfulness may assist with the management of negative emotions, thus helping to regulate symptoms of stress and feelings of negative affect related to burnout (Brown et al., 2007). Burnout is a stress related symptom (Li et al., 2019), common in high performance sport (Gustafsson et al., 2015). In support of this, Zhang et al. (2016) assessed 387 elite junior athletes on self-report measures of mindfulness, experiential avoidance, and

athlete burnout. The results provided cross sectional evidence that experiential avoidance is mediated the inverse relationship between mindfulness and three dimensions of burnout, (e.g., physical/emotional exhaustion, devaluation and reduced sense of accomplishment). These findings suggested that mindfulness is associated with athlete burnout via experiential avoidance. A case study by Jouper and Gustafsson (2013) found athletes who were burned out were more likely to engage in maladaptive coping strategies due to increased rumination. Mindfulness promotes present moment awareness which decreases rumination and may therefore minimise stress induced burnout (Li et al., 2019; Chyi et al., 2018) Other possible explanations for the negative relationship between mindfulness and burnout it is that mindfulness promotes an open and nonjudgmental awareness and attention towards an athlete's experiences in the present moment. As such, athletes high in mindfulness are less prone to critical self-evaluation, rumination on distressing thoughts, and experiential avoidance coping, which may minimise maladaptive responses to inevitable stressors, and reduce an athlete's risk of experiencing emotional distress and burn out (Li et al., 2019).

In further support of the relationship between mindfulness and stress in athletes, additional studies have demonstrated that mindful athletes experience less perceived stress and negative affect as well as more positive affect, than less mindful athletes (Gustafsson et al., 2015). These findings were further supported by a recent systematic review and meta-analysis by Li et al. (2019) on the effect of MBIs on athlete burnout. The study reviewed a total of 10 controlled and uncontrolled studies of moderate to high research quality that researched athletes using mindfulness. The results showed that MBIs had positive effects in burnout prevention, while meta-analytic results indicated a negative association between mindfulness and burnout through reduced reports of perceived stress. These findings provide further evidence that athlete burnout is mainly a stress related symptom

It is clear how mindfulness such as present moment awareness (Weinstein et al., 2009) can have a positive impact on a person's response to stress. It is also clear that a person's appraisal of stress plays a vital role in self-regulation under stress (Brown et al., 2003; Baumeister et al., 1998; Schwanhausser, 2009; Glomb et al., 2011). In the context of MBIs, present moment awareness may be more helpful than cognitive re-appraisal when it comes to facilitating adaptive stress responses (Donald et al., 2016). Mindfulness can therefore positively influence a person's appraisal of stress (Wendling, 2012) their direct 'in the moment'

experience of stress (Donald et al., 2016), and how a person deals with stress under demanding situations such as that of competitive sport (Gardner & Moore, 2006; Jackson & Marsh, 1996; Schwanhausser, 2009; Carrança et al., 2018; Harandi et al., 2017; Carrança et al, 2019; & Bernier et al., 2009). Therefore, it is important to consider how mindfulness might be helpful to high performance athletes experiencing high levels of stress.

8. Mindfulness and Psychological Inflexibility

Psychological flexibility is a key mechanism of change in mindfulness and acceptance based interventions such as ACT (Hayes et al., 2004). The primary focus of ACT is to develop a person's psychological flexibility, defined as "contacting the moment more fully as it is and persisting or changing in behaviour in the service of chosen values." - (Hayes et al., 2013, p. 10). Psychological flexibility is about engaging in behaviours that align with a person's values rather than simply reducing unpleasant internal states through experiential avoidance. Psychological flexibility and mindfulness are closely related in that both constructs concern the regulation of how a person contacts and responds to thoughts, emotions and internal sensations in the present moment (Masuda & Tully, 2012). Psychological flexibility is a particular imperative in high performance athletes, as athletes are required to disengage from disruptive stimuli, such as difficult thoughts and emotions in order to sustain focus on task relevant cues (Johles et al., 2020). Psychological flexibility promotes better regulation of thoughts, emotions and physical sensations with a present moment focus on the task at hand, even in stressful situations (Gardner & Moore, 2006).

Psychological flexibility is a multifaceted construct with many dynamic processes that unfold over time. Such dynamic processes are the result of how a person: "(1) adapts to fluctuating situational demands, (2) reconfigures mental resources, (3) shifts perspective, and (4) balances competing desires, needs, and life domains." - (Kashdan & Rotterburg, 2010, p. 866). This explanation of psychological flexibility focuses on transactions between people and their environment, rather than focusing on specific internal content. Psychological flexibility is promoted through six core processes as seen in the ACT Hexaflex Model. These include: " acceptance (i.e., a willingness to contact unwanted experiences fully), contact with the present moment (i.e., being in touch and aware of one's experiences), self as context (i.e., keeping perspective of oneself within one's experiences), defusion (i.e., being able to step back from

unwanted experiences without getting stuck in them), committed action (i.e., maintaining behaviours that move toward important aspects of life), and values (i.e., staying connected to the areas of life that are important, giving direction to behaviours)." (Rolffs et al., 2018, p. 458). Mindfulness process within ACT include acceptance, contact with the present moment, self as context and defusion (Hayes et al., 2006). The opposite of psychological flexibility is psychological inflexibility, defined as "the rigid dominance of psychological reactions over chosen values and contingencies in guiding action." (Bond, Hayes, Baer, Carpenter, Guenole, Orcutt & Zettle, 2011, p. 678). For the purpose of this study, we will now be referring to psychological inflexibility throughout.

Experiential avoidance is a key characteristic of psychological inflexibility and means a person attempts to alter the intensity or frequency of unwanted internal experiences to avoid the experience of such experiences (Roemer & Orsillo, 2002). Experiential avoidance can be thought of as a strategy to provide a person experiencing heightened negative affect a means of short-term emotion regulation. This can lead to a type of short-term gratification, making experiential avoidance a reinforced coping mechanism. In this state, a person learns that avoidance strategies will reduce negative affect for a short time, despite longer term detriments (Gardner & Moore, 2006; Johles et al., 2020). Experiential avoidance in athletes occurs when an athlete's behaviour serves to reduce personal discomfort, and focuses on and is driven by internal experiences such as that of fluctuating emotions, rather than on a willingness to experience internal experiences in order to regulate attention from internal experiences to the task at hand (Henrikson et al., 2019). The opposite of experiential avoidance is experiential acceptance, which is a willingness to experience internal events in pursuit of personal values. In many MBIs, experiential acceptance is a core process when it comes to enhancing mindfulness and decreasing psychological inflexibility (Hayes et al., 2004; Ciarrochi et al., 2010).

Psychologically inflexible individuals are likely to automatically react from mental schemas which involve inaccurate judgements and maladaptive behaviour to situations which require a more mindful response (Glomb et al., 2011). Mental schemas can influence how a person experiences a certain situation, and this is supported by the Relational Framework Theory of Language which suggests that the building blocks of human language and higher cognition are related to a person's ability to create bidirectional associations between thoughts,

objects and events. The Relational Framework Theory is a guiding principle of ACT, which uses mindfulness and acceptance to help individuals become less psychologically inflexible, and it reduces the tendency to make maladaptive associations between words (e.g., thoughts) and events that may prevent a person from valued action and optimal behaviour (Wendling, 2012).

The aim of mindfulness and acceptance in the context of ACT (Hayes et al., 2004) and Mindfulness Acceptance Commitment Therapy (Gardner, 2009) is to change how a person relates to unwanted thoughts, emotions and sensations where thoughts may imply a threat based on past experiences. A person's ability to become mindfully aware of, accept and defuse from threatening thoughts allows for values driven behaviour, further decreasing psychological inflexibility (Luoma et al., 2008, p. 24 - 39). This process of reducing psychological inflexibility can be explained by the Transactional Model of Stress which postulates a person's experience of stress is determined by the interaction between a person's appraisal of a stressful situation and the situation itself (Eatough, 2015).

A reduction in psychological inflexibility is promoted through a number of dynamic processes, including mechanisms of mindfulness such as contact with the present moment, defusion and acceptance (Rolffs et al., 2018). In ACT (Ciarrochi et al., 2010) and Mindfulness Acceptance Commitment Therapy (Gross et al.,2018), mindfulness techniques geared towards reducing psychological inflexibility include mindfulness psychoeducation, the use metaphors to train concepts like cognitive defusion, and experiential exercises such as meditation - all of which aim to help a person act in alignment with their values rather than react from their emotions (Kaufman et al., 2005). Mindfulness meditation is used in many MBIs to reduce psychological inflexibility (Ciarrochi et al., 2010). Mindfulness Acceptance Commitment Therapy (Josefsson et al., 2019), Mindfulness-Based Stress Reduction (Kaufman et al., 2018) and Mindfulness Based Cognitive Behavioural Therapy (Scott-Hamilton & Schutte, 2016) encourage regular meditation practice. For example, Mindfulness Acceptance Commitment Therapy promotes meditation by asking individuals to "guide their attention on a chosen object or event (focused attention meditation), or the monitoring of awareness itself, without selecting, judging or focusing on any particular object (open-monitoring meditation) or on developing love and compassion for themselves and others (loving-kindness meditation)." (Henrikson et al., 2019, p. 8). Informal mindfulness practice of nonjudgemental present moment awareness

is also encouraged during day-to-day activities through mindful eating, connecting with others and playing sport (Rolffs et al, 2018).

Studies have highlighted a negative relationship between mindfulness and psychological inflexibility. One study evaluated the potential efficacy of a novel adjunctive mobile app designed to enhance the acquisition, strengthening, and generalisation of ACT skills with a group of participants suffering from depression and/or anxiety. Participants were instructed to use the ACT Daily Mobile App, which included guided mindfulness meditations once a day over two weeks. Pre- to post- intervention self-report measures suggested a negative relationship between the use of the ACT Daily Mobile App and psychological inflexibility (Levin et al., 2017). Another study investigated whether mindfulness and psychological inflexibility uniquely and separately accounted for variability in psychological distress in a non-clinical sample of university students. Results from this study indicated that psychological inflexibility and mindfulness were negatively related, and further revealed a negative relationship between mindfulness and depression, anxiety, and general psychological distress (Masuda & Tully, 2012).

Studies investigating the relationship between mindfulness and psychological inflexibility in athlete populations have also surfaced. A case study applied Mindfulness Acceptance Commitment Therapy to an adolescent competitive springboard diver over nine individual sessions. Self-report measures assessed experiential acceptance and psychological inflexibility via the Action and Acceptance Questionnaire (AAQ-2). The results suggested a significant increase in experiential acceptance and decrease in psychological inflexibility pre- to post- intervention (Schwanhausser, 2009). Carrança et al., (2019) randomly assigned elite soccer players to a 9-week Mindfulness Based Program for Elite Soccer Athletes or a control intervention. Athletes who participated in the mindfulness program reported decreased psychological inflexibility from pre to post intervention. Participants who reported low psychological inflexibility also reported greater levels of performance.

Gross et al. (2018) investigated the effectiveness of Mindfulness Acceptance Commitment Therapy compared to PST on mental health and sports performance with a women's division III NCAA basketball team. The Mindfulness Acceptance Commitment Therapy approach to performance enhancement is based upon the notion that reducing anxiety

and negative thoughts while increasing confidence does not necessarily result in optimal performance; instead, performance outcomes are associated with reduced psychological inflexibility, influenced by the ability to remain nonjudgmentally present with one's internal experiences, while persisting with the task at hand and in alignment with one's values, regardless of internal discomfort. Athletes were randomly assigned to a Mindfulness Acceptance Commitment Therapy or PST intervention group which consisted of a seven-week long program. Self-report measures were taken pre and post intervention. Findings suggested that participants in the Mindfulness Acceptance Commitment Therapy group reported decreased psychological inflexibility in comparison to the PST group. Furthermore, decreases in psychological inflexibility coincided with decreases in psychological distress at a one month follow up. Results also indicated that participants in the Mindfulness Acceptance Commitment Therapy group reported increased overall sports performance from pre- to post- intervention. Findings of decreased psychological inflexibility suggested that mindfulness and Mindfulness Acceptance Commitment Therapy, in particular, are effective in simultaneously enhancing athletic performance and reducing perceived levels of stress through mechanisms of psychological flexibility.

Evidence, although limited, has indicated a negative relationship between mindfulness and psychological inflexibility in athlete populations (Gross et al., 2018; Carrnaça et al., 2019; Levin et al., 2017; Schwanhausser, 2009). Studies have suggested a negative relationship between mindfulness and psychological inflexibility in nonclinical college students (Masuda & Tully, 2012), clinical populations (Levin et al., 2012) and athletes (Schwanhausser, 2009; Carrança et al., 2019; Gross et al., 201) and a positive relationship between decreased psychological inflexibility and athlete performance (Carrança et al., 2019; Gross., et al, 2018). Decreased psychological inflexibility has specific benefits, especially when it comes to promoting adaptive behaviour in stressful situations (Glomb et al., 2011). Being an important mechanism targeted by many mindfulness based interventions, psychological inflexibility should be considered when investigating the effects of mindfulness on athlete populations.

9. Mindfulness and Dispositional Mindfulness

Mindfulness practice refers to applied methods through which mindfulness is fostered and is intentional. A way a person can practice mindfulness is through meditation (Gross et al., 2018). Dispositional mindfulness is the tendency to be mindful in everyday life, when mindfulness becomes more trait-like, rather than an intended practice (Birrer et al., 2012). For the purpose of this study, dispositional mindfulness will be defined as "a temporary more or less stable state or trait, and the tendency to act mindfully in everyday life" (Birrer et at., p. 239, 2012).

Meditation is one way to practice mindfulness more formally, and it has been shown to enhance dispositional mindfulness whereby "formal mindfulness practice with bare attention, the intention to self-regulate, and a nonjudgmental and accepting attitude will enhance the disposition to act with more attention and a nonjudgmental attitude" (Birrer et al., 2012 p. 5). Informal mindfulness practice such as intentional participation in routine everyday activities with greater present moment awareness and a nonjudgmental, accepting attitude, also increases dispositional mindfulness (Carmody & Baer, 2008). Enhanced dispositional mindfulness encourages individuals to become more aware and accepting of their experiences. This allows athletes to experience an array of thoughts and emotions without letting such thoughts and emotions impair their ability to focus on the task at hand and to optimally execute task-relevant skills when required (Bishop et al., 2004).

There have been mixed findings about the relationship between mindfulness interventions and dispositional mindfulness. A randomised controlled trial by Gross et al. (2018) investigated the effectiveness of Mindfulness Acceptance Commitment Therapy compared to PST for the mental health and sports performance of female collegiate athletes. The results showed that the Mindfulness Acceptance Commitment Therapy group obtained significantly greater improvements in emotional regulation and decreased psychological inflexibility compared to the PST group. However, there were no differences in dispositional mindfulness between and within groups pre- to pos-t intervention. This an important finding to consider as the authors suggested that the lack of changes in dispositional mindfulness over time may have been due to the mindfulness program not putting enough focus into promoting the formal mindfulness meditation practice component of the program, while at the same time

excluding mindfulness monitoring forms throughout the intervention, which had been suggested as part of the Mindfulness Acceptance Commitment course outline. Suggestions have been made for future studies to further investigate whether an intervention with more of an intensive focus on formal and regular between meditation sessions would influence dispositional mindfulness over time.

Other studies have shown more promising results. Evidence has shown that changes in cortical grey matter structure in multiple brain regions are greater in experienced meditators compared to non-meditators and that such changes are related to improved mindfulness over time (Lazar et al., 2005; Hernández et al., 2016). Lazar et al. (2005) found that brain areas associated with attention, interoception and sensory processes were thicker in grey matter in participants with extensive meditation experience compared to controls. A similar study by Hernández et al. (2016) found that formal meditation practice resulted in changes in the brain structure over time, with long term meditators showing larger grey matter volume in certain areas of the brain compared to non-meditators. Increased grey matter volume were recorded in areas of the brain associated with sustained attention, self-control, emotional regulation, compassion and interoceptive perception. Similar findings were observed in a longitudinal study by Hölzel et al. (2011) who investigated pre- and post- changes in grey matter concentration with a control group of 17 healthy non-meditative participants and 16 healthy meditative participants during a Mindfulness Based Stress Reduction intervention. Results indicated changes in grey matter concentration in brain regions responsible for learning and memory processes, emotion regulation, self-referential processing, and perspective taking in participants in the Mindfulness Based Stress Reduction group. It was also found that those participants who displayed structural brain changes in response to mindfulness also reported greater mindfulness scores over time, specifically in sub scales related to acting with awareness, nonjudging, describing and nonreactivity. Changes in dispositional mindfulness as a result of structural changes in the brain were observed by Taren et al. (2013) who took a sample of 155 healthy adults and assessed participants on their level of dispositional mindfulness followed by structural MRI images. The results found that higher levels of dispositional mindfulness correlated with decreased grey matter volume in the amygdala. This finding suggested a clear relationship between mindfulness practice, structural changes in the brain, dispositional mindfulness and emotion regulation, which may explain why mindful individuals are better able to regulate emotions.

Other studies have shown a relationship between mindfulness practice and dispositional mindfulness with athletes. One study explored the effects of a Mindful Sport Performance Enhancement program on 25 recreational long distance runners who were randomly assigned to either a four week mindfulness intervention which included formal and informal meditation practice, or to a waitlist control group. Results indicated that the Mindful Sport Performance Enhancement group showed significant improvements in dispositional mindfulness from pre- to post- intervention compared to the control group, especially in subscales related to awareness (De Petrillo et al., 2009). Goodman et al.,(2014) conducted a randomized control pilot study with a men's division I athletic team. The results found that those who participated in a five-week modified version of Mindfulness Acceptance Commitment Therapy, which included regular formal meditation practice in combination with mindfulness psychoeducation, showed improved self-report scores of dispositional mindfulness as well as reduced perceived stress pre- and post- intervention. Another randomised control trial, by Hasker (2010), assessed the effectiveness of the Berlin Mindfulness-based Training for Athletes compared to PST. Forty-six participants were randomly assigned to a control group or a mindfulness group. Participants in the mindfulness group were subject to mindfulness psychoeducation as well as formal within session meditation practice and were encouraged to also meditate daily between sessions. Findings suggested that athletes in the mindfulness group showed significant improvements in dispositional mindfulness compared to those in the control group. The above studies have demonstrated that MBIs, particularly those that prescribe psychoeducation and meditation, may offer a uniquely effective means for increasing dispositional mindfulness in athletes (Hasker, 2010; Goodman et al., 2014; De Petrillo et al., 2009).

Josefsson et al., (2019) examined the mediating effects of emotion regulation and sport-specific dispositional mindfulness on self-rated athletic training performance following a Mindfulness Acceptance Commitment Therapy intervention compared to a PST control group. It was found that the Mindfulness Acceptance Commitment Therapy intervention influenced self-rated athletic training performance through changes in dispositional mindfulness and emotion regulation. Further, the Mindfulness Acceptance Commitment Therapy group showed greater posttest improvements in athletic mindfulness, emotion regulation abilities, and perceived performance compared to the PST group. It was concluded that dispositional mindfulness serves as important mechanisms of change in Mindfulness Acceptance Commitment Therapy, and that Mindfulness Acceptance Commitment Therapy is more

effective than PST when it comes to regulating emotions, enhancing sport specific mindfulness and performance. One explanation for the positive relationship between dispositional mindfulness and performance is that dispositional mindfulness helps athletes become less susceptible to task irrelevant distractions. Task irrelevant distractions may include being overly focused on unwanted thoughts and emotions, rather than directing attention towards task relevant stimuli and enacting values driven behaviour in service of performance goals (Giges & Reid, 2016). Dispositional mindfulness may therefore be especially important for high-performance athletes when it comes to performing under high pressure, stressful situations (Chambers et al., 2009).

The above studies have indicated a relationship between mindfulness and dispositional mindfulness in athletes. Possible mechanisms of change associated with mindfulness practice that seem to improve dispositional mindfulness include an increase in bare attention, experiential acceptance, values clarification, self-regulation, negative emotion regulation, clarity about one's internal life, psychological flexibility and less rumination (Birrer et al., 2012). Mindfulness practice has been shown to have positive effects on brain structure (Taren al., 2013; Taren et al., 2013; Hölzel et al., 2011; Lazar et al., 2005; Courtemanche et al., 2010; Hermández et al., 2016), with associated improvements in dispositional mindfulness (Hölzel et al., 2011). Greater dispositional mindfulness has been associated with less task irrelevant distractions and greater performance (Giges & Reid, 2016), reduced perceived stress (Goodman et al., 2014) and improved emotion regulation and performance (Josefsson et al., 2019) in athletes. When investigating the role of mindfulness with high performance athletes, it is therefore important to consider the how mindfulness influences athletes' dispositional mindfulness.

10. Mindfulness and Self-Compassion

Self-compassion is experienced when a person is able to disidentify with their thoughts and emotions and instead, create a mental space to promote loving kindness towards oneself (Mosewich et al., 2013). Self-compassion is defined as "being touched by and open to one's suffering, not avoiding or disconnecting from it, generating the desire to alleviate one's suffering and to heal oneself with kindness. Self-compassion also involves offering nonjudgmental understanding to one's pain, inadequacies and failures, so that one's

experience is seen as part of the larger human experience." (Schoenefeld & Webb, 2013, pp. 3). Self-compassion is made up of three main components including, 1) self-kindness (the ability to treat oneself with care rather than harsh self-judgment), 2) common humanity (recognising that imperfection is a shared aspect of the human experience rather than feeling isolated by one's failures) and 3) mindfulness (holding one's experience in balanced perspective rather than exaggerating the dramatic storyline of suffering) (Raes et al., 2011).

Mindfulness makes a direct contribution to self-compassion, including the development of self-kindness and common humanity. Key aspects of mindfulness including nonjudgmental present moment awareness, experiential acceptance and cognitive defusion of internal experiences foster self-understanding and less self-criticism, which directly enhance self-compassion. In addition, mindfulness associated with acceptance of all internal processes as a shared human experience, counters feelings of separateness from the rest of humanity, thus enhancing feelings of interconnectedness (Levin et al., 2018). Not only does mindfulness promote self-compassion, but self-compassion promotes mindfulness. Increased self-kindness and a sense of commonality with all of humanity lessens the intensity of negative internal experiences, fostering a balanced sense of awareness and acceptance of thoughts and emotions where a person is able "to neither run away from nor run away with the feelings" (Neff, 2003, p. 89). Self-compassion also requires that individuals do not avoid or repress unpleasant thoughts and emotions, and that they acknowledge and feel compassion for their experience (Birnie et al., 2010). This is similar to the process of experiential acceptance, a key mechanism of mindfulness and many mindfulness and acceptance-based interventions such as ACT (Schwabach et al., 2019), Mindfulness Acceptance Commitment Therapy (Josefsson et al., 2019) and Mindfulness Based Cognitive Behavioural Therapy (Cayuon et al., 2018 p. 31). Both acceptance and mindfulness are core processes of self-compassion whereby, "a certain degree of mindfulness is needed to allow enough mental distance from one's negative experiences that feelings of self-kindness and common humanity can arise." (Neff, 2003, p. 89).

A positive relationship between mindfulness and self-compassion has been supported by research. Taylor et al. (2014) conducted a single blind randomised control trial with university students to examine the efficacy of an eight-week self-help version of Mindfulness Based Cognitive Behavioural Therapy. Participants engaged in a mindfulness-based home practice two to three times a week, which included regular meditation practice. At post

intervention follow ups, students reported significant improvements in self-reports of satisfaction with life, mindfulness and self-compassion with medium to large effect sizes. These improvements were maintained in a ten week follow up. It was concluded that mindfulness and self-compassion are important mechanisms of change in Mindfulness Based Cognitive Behavioural Therapy. Orzech et al. (2009) examined the role of intensive mindfulness training on changes in day-to-day experiential processing, psychological symptoms, resilience, and wellbeing in two groups of community adults. The study found that intensive formal mindfulness meditation training was significantly related to increases in trait mindfulness in comparison to pre and post training wait list controls, and that greater meditation experience was associated with improvements in dispositional mindfulness and acceptance, and also self-compassion.

Research in neuropsychology has indicated a link between compassion, neural reactivity and meditation. Preliminary data has suggested that the modulation of reactivity by compassion is mirrored at a neural level in more experienced meditators. Participants from this study were instructed to mindfully meditate on compassion by thinking of someone they loved and to let their mind be consumed by feelings of altruistic love (wishing wellbeing) or of compassion (wishing freedom from suffering) toward these people. Participants were then instructed to bring themselves into a neutral non-meditative state without specific cognitive content, and with a lack of present moment awareness. Participants were instructed to cycle through meditative and non-meditative states while being exposed to auditory emotional triggering sounds (positive, negative and neutral) during MRI. Findings confirmed that compassion enhanced emotional and somatosensory brain representations of others emotions and that this effect was modulated by the level of meditation expertise. Expert meditators showed an increase in heart rate as well as greater pattern activation in the insular context compared to novice meditators, but only during compassion states (Lutz et al., 2009). It was concluded that compassion was strongly tied with meditation and meditation experience. Although this study examined compassion rather than self-compassion, Neff (2003) highlighted the close link between compassion and self-compassion whereby "compassion involves being touched by the suffering of others, opening one's awareness to others pain and not avoiding or disconnecting from it, so that feelings of kindness toward others and the desire to alleviate their suffering can emerge", (Neff, 2003, p. 86). Self-compassion is therefore similar to compassion when it comes to an having an open awareness and acceptance of self or

others pain and suffering by not avoiding or disconnecting from it. These findings provide promising evidence on the positive effects of mindfulness meditation and compassion at both an emotional, physiological and neural level (Lutz et al., 2009).

Self-compassion contradicts the often harshly critical and overly evaluative tendencies of athletes, but has recently gained attention in sport due to its potential in aiding adaptive coping mechanisms under the grueling demands of competitive sport, and helping athletes achieve their performance potential while fostering enhanced wellbeing (Mosewich et al., 2019) A pilot study by Carrança et al. (2019). explored the effects of a Mindfulness Based Soccer Program on athlete's self-compassion, mindfulness, and psychological flexibility. Results indicated an increase in self-compassion from pre- to post- intervention. Changes in self-compassion demonstrated a statistically significant change from pre- to post- intervention, and had the largest effect size out of all constructs in the study. The results further demonstrated that self-compassion is positively related to adaptive psychological characteristics such as mindfulness, enhanced awareness and flow, and inversely related to maladaptive psychological characteristics such as avoidance coping. Mosewich et al. (2019) investigated the effects of a self-compassion intervention on negative cognitive states and self-compassion in a group of female university athletes. Athletes who self-identified as being self-critical were randomly assigned to a self-compassion intervention or an attention control group. The self-compassion intervention consisted of a psychoeducation session and writing components completed over seven days. The mindfulness component of the self-compassion intervention required participants to describe their experience of a negative event in the sport in an objective and unemotional manner promoting awareness, experiential acceptance and defusion without over-identification with the past experience. Although the self-compassion intervention was not specifically founded on meditation, it did include mindfulness through mindful writing and concepts related to acceptance and objective awareness of internal processes. The findings indicated that the self-compassion intervention was effective in managing self-criticism, rumination, and concern over mistakes. These findings indicated that self-compassion is a potential coping resource for female athletes dealing with negative events in sport, and that self-compassion can be achieved through mindfulness.

Another study investigated how female athletes with high self-compassion perceived they became self-compassionate. The findings highlighted three main themes contributing to

the development of self-compassion: learning from others, gaining self-awareness and learning form parents. Mindfulness was a sub theme throughout the three themes. For example, parents taught participants skills when it came to developing awareness of one's thoughts and feelings. Participants reported learning from past experiences by being aware of what did and did not serve their performance and wellbeing, as well as learning not to overidentify with difficult experiences. These were all interpreted as characteristics of mindfulness (Ingstrup et al., 2017). Further, self-awareness was one of the three major themes of self-compassion; and enhanced self-awareness is also a key construct related to mindfulness (Brown & Ryan, 2003). Self-compassion also minimises perceived stress in athletes. One study with female university athletes demonstrated self-compassion as playing a direct and indirect role in the stress process of competitive female athletes. The authors concluded that self-compassion significantly predicted higher control appraisals and lower threat appraisals, which explained the adaptive coping tendencies of athletes high in self-compassion (Mosewich et al., 2019).

Studies have surfaced demonstrating a positive relationship between mindfulness and self-compassion in both non athlete (Taylor et al., 2014; Orzech et al., 2009; Lutz et al., 2009;) and athlete populations (Mosewich et al., 2019; Carrança et al., 2019). It has been suggested that the development of both mindfulness and self-compassion has the potential to help athletes better manage their expectations, standards and decisions when it comes to balancing wellbeing and performance outcomes (Mosewich et al., 2013). Because mindfulness and self-compassion go hand in hand (Neff, 2003), when investigating the effects of mindfulness with athlete populations, it is important to consider changes in self-compassion in response to mindfulness.

11. Mindfulness Smartphone Applications

Smartphone applications offer an interesting object of study when it comes to exploring the relationship between mindfulness and associated psychological outcomes, including perceived stress. Smartphone ownership is increasing at a rapid rate. In 2016, 77% of Americans reported owning a smartphone compared to only 35% in 2011 (Tsetsi & Smith, 2017). Mindfulness and meditation have also become one of the most popular practices for supporting wellbeing and managing stress with over 18 million people practicing some form of meditation in the United States of America (Anasori, Bayighomog, & Tanova, 2019). The use of smartphone applications as a means to learn and practice meditation is also becoming

more popular. In 2017, Apple named the meditation app 'Calm' its smartphone application of the year, while reports showed meditation applications to be the top trending applications in the Apple app store. Between 2012 and 2018, internet searches for "meditation app" increased significantly, exceeding searches for "meditation book", and were close in number for searches containing the words, "meditation centre", suggesting the interest in learning meditation via a smartphone application was growing, rivalling interest in learning meditation via person-to-person (Littlefair et al., 2018). In support of the popularity of mindfulness smartphone applications, research has indicated smartphones as being the preferred method of contact for many young people (Flett et al., 2020).

One possible explanation for the popularity of meditation smartphone apps when it comes to supporting a person's wellbeing in countries like the United States is the western individual-oriented culture, which has a tendency to view wellness as a significant part of individual achievement. A person's wellbeing is thought of as a reflection of moral character, daily habits and personal success, while distress is primarily viewed as individual failure. Therefore, the responsibility for a person's health and wellness is perceived to fall upon the individual (Saint Arnault, 2009). With chronic stress on the rise (van Kraaij et al., 2020) and a culture of self-help seeking individuals (Saint Arnault, 2009), it seems useful to further explore how mindfulness and meditation smartphone applications can be used as a tool for assisting people who experience high levels of stress. Because athletes are especially vulnerable to high stress (Dehghani et al., 2018) and are very aware of the detrimental effects that stress may pose on their performance outcomes (Furrer et al., 2015), smartphone meditation applications may be of particular use to athletes when it comes to managing the inevitable stressors that go hand in hand with competitive sport.

Mindfulness has been shown to have beneficial effects in numerous areas; however most MBIs are quite time consuming, often running for at least four and sometimes up to ten weeks with rigorous coursework, including in person attendance. This makes it difficult for users to commit and fully engage in mindfulness practice while balancing other life commitments (Hendricks et al., 2019). For example, the most popular MBI is Mindfulness Based Stress Reduction which calls for an eight-week commitment to the program with weekly two-hour sessions, including homework assignments of roughly 45 minutes per day, six days a week (Shapiro et al., 2008). Likewise, athletes participating in Mindfulness Acceptance

Commitment Therapy are required to attend eight one-hour sessions over eight weeks, with inbetween session course work and daily mindfulness meditation practice (Josefsson et al., 2019). Such interventions are time-consuming for busy athletes, especially when balancing full time training with other sport and life commitments (Rist & Pearce, 2017).

Challenges associated with the required time commitments of popular MBIs have been demonstrated in the workplace. For example, one study delivered an eight-week Mindfulness Based Stress Reduction course with healthcare professionals. Results indicated that 44% of the mindfulness group dropped out due to lack of time and increased responsibility (Shapiro et al., 2011). In the workplace, such limitations have led to a change in mindfulness teaching methods from face-to-face interventions to web-based platforms and the use of smartphone applications (Hendrick et al., 2020).

As a result of the mindfulness effectively decreasing perceived stress (Mohammed et al., 2018; Norouzi et al., 2020; Gross et al., 2014; Goodman et al., 2014) and increasing performance outcomes (Bühlmayer et al., 2017; Gross et al., 2018; Schwanhausser, 2009; Josefsson et al., 2019), it is no wonder mindfulness has become a popular approach for managing athletes' stress (Bühlmayer et al., 2017). Yet low attendance rates in lengthy traditional face-to-face MBIs remains an issue (Shapiro et al., 2008).

Mindfulness delivered via smartphone applications may offer a convenient, low cost, flexible, anonymous and standardised alternative or complementary means of mindfulness training, thus mitigating some of the difficulties experienced by busy individuals trying to participate and benefit from lengthy face to face MBIs (Rist & Pearce, 2017). Furthermore, the preference for digital psychotherapeutic interventions is increasing with a greater preference for online mental health interventions and lower preference for face-to-face therapy (Renn et al., 2019). This calls for a better understanding of how smartphone applications delivering mindfulness and meditation can be used to support athletes who may be experiencing high levels of stress.

Studies have been published on the effects of meditation smartphone applications with non-athlete populations, particularly medical staff and students. Wylde et al. (2017) measured the effects of a traditionally delivered mindfulness intervention compared with a smartphone

delivered mindfulness intervention with a group of novice nurses. Participants in the smartphone group reported increased compassion, satisfaction, and decreased burnout as well as significantly greater increases in facets of mindfulness ("acting with awareness" and "non-reactivity to inner experience") compared to the traditionally delivered mindfulness group. Results confirmed that smartphone delivered mindfulness interventions may offer greater benefits than traditionally delivered mindfulness interventions when it comes to coping with burn out and stress in nurses. It is possible that smartphone interventions promote meditation being integrated into daily life, at work and at home, by focusing on acting with awareness and non-reactivity to inner experience. Traditionally delivered mindfulness interventions, on the other hand, tend to focus on in-session meditation. Although participants in the traditionally delivered mindfulness intervention group were encouraged to practice between sessions, they may have had difficulty embodying mindfulness skills without the support of a teacher at home. In this sense, smartphone applications may foster less dependency on a mindfulness and meditation teacher or therapist, thus encouraging more intrinsic motivation when it comes to regular practice.

Bowen and Kurz (2012) highlighted the importance of between session practice through the use of smartphone apps for improving participants development of mindfulness skills and associated benefits. Between session practice over the course of an eight-week MBI was predictive of mindfulness at post intervention, while client-rated therapeutic alliance was a significant predictor at the two month follow up. This study has highlighted the importance of between session practice, and a study by Wylde et al. (2017) has highlighted the benefit of smartphone applications for encouraging between session practice.

A recent pilot study conducted by Wen et al. (2017) ran a quasi-experimental design to investigate the feasibility of using the Headspace mindfulness app to benefit medical residents' mindfulness and wellbeing. Participants used the app on a self-guided basis for four weeks. Pre- to post- intervention measures demonstrated a significant increase in mindfulness and positive affect over time. Increased use of the app was significantly associated with increased frequency of self-reported dispositional mindfulness outside app usage and in day-to-day life. Although the studies of Wylde et al. (2017) and Wen et al. (2017) were not with athletes, they are still relevant in that they highlighted both the convenience and benefits of mindfulness smartphone applications with populations who may be susceptible to high stress and time poor.

Similar to athletes, doctors are also vulnerable to burnout, with medical residents reporting significant levels of burnout across specialties, associated with a negative effect on performance in terms of patient care, as well as individual wellbeing (Kang et al., 2013). In addition, medical students, like athletes, have limited personal time due to busy schedules, making it challenging to commit to time consuming wellness interventions. Burnout is also one of the more prominent issues related to perceived stress in athletes (Chyi et al., 2018). The above findings have suggested that regular access to smartphone applications may encourage busy individuals to practice mindfulness more frequently, thus leading to more positive outcomes (Wen et al., 2017; Wylde et al., 2017).

Additional studies have shown the effectiveness of mindfulness and meditation apps with healthy populations. A large scale randomised control study by van Emmerik et al. (2017) evaluated the immediate and long-term effects of a mindfulness-based meditation app with a total of 383 participants who were randomly assigned to either a mindfulness group or a waitlist control group for a five-week mindfulness program delivered by a smartphone application. The mindfulness group was a self-help intervention which included forty mindfulness audio exercises delivered via a smartphone app. Results of the study showed large significant increases in mindfulness after eight weeks, and small to medium effects on all five individual facets (observing, describing, acting with awareness, non-judging, and non-reactivity). The self-help mindfulness-based meditation app was associated with significant improvements in general psychiatric symptoms and moderate increases in quality of life; improvements were maintained at the three months follow up.

Additional studies have shown that the use of mindfulness apps decreases perceived stress. Huberty et al. (2019) conducted a randomised control trial with 88 stressed college students to test the initial efficacy and sustained effects of an eight-week mindfulness meditation mobile app called ‘Calm’, and compared results to a waitlist control group on measures of stress, mindfulness, and self-compassion. The results indicated significant differences between the intervention and control groups in all outcomes including decreased stress and increased mindfulness and self-compassion. These changes were maintained at a 12 week follow up, with moderate to large effect sizes. The size of change in reduced perceived stress was greater in the intervention group than in the control group at post intervention and follow up. This study also demonstrated significant improvements with large

effects in mindfulness scores and self-compassion in the meditation app group compared to the control group.

In another study, Flett et al. (2019) conducted a randomised control trial with 208 undergraduate students assigned to two experiential meditation phone app groups or a control group. Participants were randomly assigned to two meditation groups and were asked to meditate for ten minutes a day over forty days using two different mindfulness apps known as Head Space and Smiling Mind; both apps taught participants focused attention guided meditations (e.g., focused attention to body parts through a body scan, internal sensations including thoughts and emotions, breathe and mindful eating). The results found that both of the mindfulness meditation app users reported greater improvements in several mental health outcomes compared to the placebo control group, including resilience, mindfulness, college adjustment and depressive symtpoms. However, the improvements varied by app and frequency of meditation activity whereby app use during the 30-day period significantly moderated the effect of the meditation on changes in depressive symptoms, anxiety, college adjustment, and mindfulness where those who used the app more frequently reported greater benefits.

Most notably, both groups reported a small but significant reduction in depressive symptoms. Students who used the app more frequently during the 30 day intervention showed the greatest benefits in terms of mindfulness, college adjustment, depressive symptoms and anxiety. Interestingly, participants in the Smiling Mind app condition reported immediate but not sustained improvements in resilience while participants in the Head Space reported delayed improvements small in resilience after 30 days of using the app. Participants using Head Space app reported a small increase in mindfulness whereas Smiling Mind app users did not. In addition, poor app adherence and a high drop out rates were an issue within the first 30 days of the intervention. One possible explanation for small effect sizes across both meditation conditions and low app adherence is that neither apps included psychoeducation. Both apps started with introductory short guided meditations but did not educate participants on key benefits and definitions of mechanisms of mindfulness. Research has suggested psychoeducation can be helpful for increasing participants engagement with apps (Hendricks et al., 2019; Scott-Hamilton et al., 2016).

Studies applying mindfulness and meditation apps to athletes are still quite limited; only two studies have been found that investigated the usefulness of mindfulness apps with athletes. Carrança et al. (2019) explored the impact of an eight-week Mindfulness Based Soccer Program with elite soccer players. The study used traditionally delivered in person mindfulness training with meditation smartphone apps for regular between session assignments. The study also implemented psychoeducation one week before the intervention commencement to ensure clarity of delivery. The results suggested that the Mindfulness Based Soccer Program was effective in enhancing elite soccer performance, self-compassion, psychological flexibility, mindfulness and flow state. Although the mindfulness program was predominantly delivered in person, smartphone applications complemented in session training and may have enhanced positive effects via between session practice. The effectiveness of mindfulness apps in this study cannot be determined as the relationship between the use of mindfulness apps and psychological outcomes was not directly measured. However, this study showed that apps can be used to compliment in person MBI intervention with athlete populations.

One other study using mindfulness apps with athletes showed fewer promising results. Rist and Pearce (2017) explored whether two popular mindfulness smartphone apps (Headspace and Cognifit) would improve athlete engagement in mental training programs with forty-six professional Australian rules male football players. Players were assessed pre- and post- a four-week mindfulness program on engagement, sleep, resilience, flow state, determination, and overall wellbeing. Findings suggested that neither of the mindfulness smartphone applications improved compliance with mental training programs, or significantly improved outcomes in the professional athlete environment. However, this study should not be ruled out. Instead, study limitations must be considered for future research. First, engagement in app participation throughout the study significantly decreased over the four weeks with a 38% drop out rate in the Headspace group, a 43% drop out in the Cognifit group and a 42% drop out in the control group. Future research should consider ways to increase participant engagement in MBIs using smartphone applications. The author highlighted the importance for elite athletes to have a clear structure to help them complete daily tasks associated with being a professional athlete. It may be that mindfulness smartphone apps could have a positive impact if they were more structurally integrated into the sports teams' training regime. Top professional basketball teams have demonstrated how mindfulness can be successfully integrated into demanding training regimes where mindfulness has been a key part of LA

Lakers and Chicago Bulls training since the early 1990's, during which both teams obtained multiple world titles (Kaufman et al., 2009; Riskin, 2002). Moving forward, to encourage participant engagement, coaching staff and practitioners implementing MBIs using smartphone applications should consider delivering psychoeducation, addressing the benefits of mindfulness and meditation in relation to improved psychological functioning and performance outcomes (Carrança et al., 2019; Scott-Hamilton et al., 2016).

The convenience, accessibility, and popularity of mobile phone applications makes them a useful tool when it comes to delivering MBIs to populations who may be time poor and who may not have the resources to participant in a private or group in-person interventions (Hendrick et al., 2020). Accessibility to meditation via a smartphone application may be especially helpful to high performance athletes when it comes to balancing mental skills practice with meditation, training, competition and other life commitments (Rist & Pearce, 2017). Based on research that has demonstrated that mindfulness and meditation app usage may reduce burnout (Wylde et al., 2017) and perceived stress (Huberty et al., 2019; Flett et al., 2019), high performance athletes experiencing high levels of stress may particularly benefit from using smart phone meditation applications.

12. Psychoeducation

Psychoeducation in combination with meditation practice via smartphone applications may give participants a better understanding of how to meditate and the benefits associated with meditation, thus motivating app users to engage with meditation apps more consistently over time (Hendricks et al., 2019). Psychoeducation is a key component of many of popular MBIs including Mindfulness Acceptance Committment Therapy (Josefsson et al., 2019), Mindfulness Based Cognitive Behavioural Therapy (Gu et al., 2018), Mindfulness Based Stress Reductions (Norouzi et al., 2020) and Acceptance Commitment Therapy (Hayes et al., 2004). For example, module one of the Mindfulness Acceptance Commitment Therapy includes a psychoeducation session to establish an effective working alliance and to connect theoretical rationale of the Mindfulness Acceptance Commitment approach with athletes' experiences and hopes (Josefsson et al., 2019).

The need for psychoeducation in MBIs has been demonstrated in research. A qualitative study explored how members of a Division I varsity women's soccer team experienced a six-week mindfulness meditation training for a sport program. During post mindfulness meditation training interviews, athletes reported enhanced ability to accept difficult experiences whilst experiencing a more adaptive relationship with their emotions, both on and off the field. Enhanced mindfulness, awareness, and acceptance of emotional experiences were attributed directly to the mindfulness training. Interestingly, in a post intervention follow up interview, participants reported challenges in struggling with the prescribed between session meditation practice due to the lack of understanding of how meditation related to soccer. Interviewee recommendations highlighted the need for future interventions to run psychoeducation to educate participants on mindfulness, including benefits and personal relevance of mindfulness practice in relation to their sport, and to avoid confusion and increase participant engagement (Baltzell et al., 2014). A mindfulness study with a group of cyclists suggested that low attrition rates in an eight-week face to- ace mindfulness intervention may have been due to regular contact with the facilitator. Athletes in the mindfulness group became more open to meditation after the facilitator helped make the connection between meditation techniques and the applicability to their sport through psychoeducation (Scott-Hamilton et al., 2016). Both of these studies are indicative of the importance of some form of psychoeducation for enhancing engagement with meditation practice.

Most studies highlighting importance of mindfulness psychoeducation have been published with non-athlete populations, but are nonetheless relevant. A longitudinal case study by Hendricks et al. (2019) measured levels of dispositional mindfulness and perceived stress in participants who attended a mindfulness psychoeducation session before using the app against those who did not attend psychoeducation. Advisors who participated in the psychoeducation session significantly increased usage of the 10% Happier phone app; this indicated the importance of initial education on participant's usage of the app. Similar results were found in a randomised control trial investigating whether a mindfulness meditation program delivered via a smartphone application could improve psychological wellbeing, reduce job strain and reduce ambulatory blood pressure (a physiological sign of stress) during the workday of participants from pharmaceutical firms and high tech companies. Participants were randomised into a waitlist control group or intervention group. The intervention group attended a one hour in person introductory psychoeducation talk about meditation delivered

through several short introductory videos that explained the rationale for mindfulness meditation and described classic mindfulness techniques. Participants were instructed to complete one guided meditation per day for eight weeks using the Headspace smartphone app. Results suggested a significant improvement in wellbeing, perceived stress, job strain, and perceptions of workplace social support (Bostock et al., 2019). This is a key finding to consider as it has highlighted the importance of psychoeducation combined with meditation.

Further research may benefit from exploring the effects of psychoeducation alone to determine if the app would be as effective without psychoeducation. A recent study by Kappen et al. (2019) assigned participants to an online psychoeducation or mindfulness group to assess the effects of a short online mindfulness intervention on relationship satisfaction and partner acceptance. Both conditions included the same psychoeducation material. The psychoeducation session was aimed at enhancing participants' understanding of and motivation to do the assigned exercises while, at the same time, educating participants on the negative effects associated with automated thought and behavioural patterns. The results indicated that general relationship satisfaction and partner acceptance increased for both conditions, further highlighting the benefits of psychoeducation. Interestingly participants in the mindfulness group with low baseline levels of trait mindfulness, reported more relationship satisfaction than those low in mindfulness who were in wait list control condition. A possible explanation may be that in order to benefit from short term mindfulness interventions, people who are not naturally mindful may need to practice formal mindfulness more than people who are already mindful. This study has demonstrated the positive effects of psychoeducation, as well as the benefits of psychoeducation combined with mindfulness training, particularly with participants low in mindfulness.

Additional research has further demonstrated the usefulness of psychoeducation to complement MBIs using smartphone apps. A randomised control trial assessed improvements in stress, affect, and irritability following brief use of a mindfulness-based smartphone application intervention with 171 meditators. Participants were randomly allocated to an introductory mindfulness meditation program or to a psychoeducational audiobook control featuring an introduction to the concepts of mindfulness and meditation. Results showed that both interventions were effective at reducing stress, but only the mindfulness intervention had a significant positive impact on irritability, affect, and stress resulting from external pressure

(Economides et al., 2018). A literature review conducted by Rathbone and Prescott (2017) reviewed the efficacy, usability, and feasibility of smartphone applications in the form of mobile health interventions for self-guided care. Findings showed that features of smartphone applications including regular notifications aimed at psychoeducation are effective when it came to enhancing physical and mental health outcomes. Further, a review of popular smartphone application for depression and anxiety found that 52% of the 27 apps reviewed included some form of psychoeducation, with psychoeducation, mindfulness and meditation being the most common. This is not surprising considering that psychoeducation is a key component of most evidence-based mindfulness interventions (Kappen et al., 2019).

Many of the discussed studies have provided evidence that mindfulness interventions combined with mindfulness psychoeducation can improve psychological outcomes, some of which are related to stress and wellbeing, with potentially lasting effects (Hendricks et al., 2019; Bostock et al., 2019; Kappen et al., 2019; Rathbone & Prescott, 2017; Economides et al., 2018). Psychoeducation in combination with Mindfulness Based Interventions using smartphone applications may help increase participants' understanding of mindfulness, and may help associate personally relevant benefits for app usage as a way to increase engagement and smartphone application use (Gross et al., 2018; Hendricks et al., 2019). Mindfulness psychoeducation combined with meditation delivered via smartphone applications should be further investigated to determine whether this combination of psychoeducation and meditation practice is helpful tool for athletes when it comes to dealing with stress.

13. Summary

Athletes are at risk of experiencing high levels of stress, often exceeding optimal levels of performance enhancing eustress (Moen et al., 2016). As a result of high stress, athletes are at greater risk of developing anxiety, depression (De Francisco et al., 2016) and burnout (Spiotta et al., 2018), while sporting performance is also likely to suffer (Main & Grove, 2009; Bali, 2015). PST is popular intervention used to help athletes self-regulate their behaviour through a shift in mindset (Birrer & Morgan, 2010). However, research has indicated that PST may not be helpful for athlete performance (Chambless & Hollon, 1998; Gardner & Moore, 2006), and may produce a number of negative consequences associated

with an increase in undesired internal experiences (Wilson et al., 2014) and performance behaviours (Binsch et al., 2009; Wegner et al., 1993). MBIs differ from PST in that they promote an awareness of and willingness to allow all internal experiences to exist without the person becoming distracted or impaired by difficult internal experiences (Garnder & Moore; 2007; Gross et al., 2018). MBIs may be an alternative approach for enhancing athletes performance and wellbeing (Josefsson et al., 2019), and relieving stress in particular (Hargrove et al., 2013; Furrer et al., 2015; Brown et al., 2007; Gustafsson et al., 2015). Mindfulness has also been shown to reduce psychological inflexibility (Gross et al., 2018; Carrança et al., 2019; Levin et al., 2017 & Schwanhausser, 2009), increase dispositional mindfulness (Goodman et al., 2014; Josefsson et al., 2019; Hasker, 2010) and self-compassion (Mosewich et al., 2013; Carrança et al., 2019). Effective ways to learn and practice mindfulness include mindfulness psychoeducation (Baltzell et al., 2014; Scott-Hamilton et al., 2016) and meditation (Birnie et al., 2010) aimed at giving athletes both the knowledge and skills to integrate mechanisms of mindfulness into their daily life. Meditation smartphone applications are a more accessible than in-person interventions for athletes who may be time poor but willing to engage with and benefit from daily mindfulness practice (Hendrick et al., 2020). Evidence suggests that MBIs may be more beneficial to athletes than PST (Hasker, 2010; Gross et al., 2018), so it is important to consider how mindfulness through the practice of meditation and psychoeducation can benefit high performance athletes who are experiencing high levels of stress.

Chapter Three Method

1. Design

This is a single case design (SCD) with four psychometrics to measure perceived stress, psychological inflexibility, dispositional mindfulness and self-compassion. SCD is used to enable participants to undergo both experimental and control conditions for the purpose of comparison within subjects rather than between subjects (Dallery & Raiff, 2014). This type of design includes baseline measures to compare data from the different stages of the intervention.

A single case design has been chosen to determine whether there is a causal relationship between the mindfulness intervention and self-reports of perceived stress, dispositional mindfulness, psychological inflexibility and self-compassion. Using pre-intervention baseline measures, mid-intervention and post-intervention measures, participants' scores will be compared against their scores throughout three phases of the study. This type of design will lead to the identification of important principles of change related to the applied mindfulness psychoeducation and meditation intervention.

2. Hypotheses

Using high performance athletes who have high levels of perceived stress, the effect of mindfulness on self-reports of perceived stress, dispositional mindfulness, psychological inflexibility and self-compassion will be examined. We predict that at the completion of the intervention, there will be:

1. Hypothisis one: A reduction in perceived stress.

2. Hypothisis two: A reduction in psychological inflexibility.

3. Hypothisis three: An increase in dispositional mindfulness.

4. Hypothisis four: An increase in self-compassion.

3. Ethics

Ethics approval was granted by the institution ethics committee (Application 4000022511). Participants were informed of the study with an invitation letter and information sheet, and those who volunteered to participate in the study were required to complete the inclusion criteria set of questionnaires. Those who met the set inclusion criteria were selected for the study and signed a consent form before participation in the study.

4. Participants

a. Recruitment

An invitation email to participate and information sheets were distributed to the head of athlete performance of Cycling New Zealand, Snow Sports New Zealand, High-Performance Sport New Zealand and Rowing New Zealand. The email was then forwarded to high-performance athletes who were over 18 and competing at a national and or international level in their chosen sport. Participants who wished to participate in the study were invited to directly contact the primary researcher. Participants who volunteered to participate in the study underwent further testing for selection based on set inclusion criteria.

Due to challenges around gaining access to carded High Performance Sport New Zealand athletes, the research invitation was only distributed to a limited number of athletes by the above method of recruitment. As a result, the number who volunteered to participate in this study was limited. There was also a limited number of athletes who meet the inclusion criteria. To account for this, the ethics committee approved recruitment to be extended to high-performance athletes outside of the above-mentioned sporting bodies. The primary researcher used a post on social media (Facebook and Instagram) to reach a wider population of high-performance athletes. Athletes who were interested were required to directly contact the primary researcher. Volunteers were then required to undergo further testing for selection based on set inclusion criteria. Those who meet the set inclusion criteria were selected to participate in the study.

b. Confidentiality

Athletes who wished to participate in the study contacted the primary researcher. Disclosure of study participation with others (i.e., coaches, managers, teammates, family) was

at the discretion of the participant. Sporting bodies, including coaches, were not granted access to participant results. Participants were granted access to a summary of the research findings on completion of the study on request, but not their individual results. Participant names and any identifiable information were not published in the final thesis.

c. Inclusion

The initial lower cut off inclusion score of perceived stress was calculated by adding 2 standard deviations to the mean score recorded by Cohen and Williamson's (1988) validation study of the PSS-10 with American residents published Spacapan and Oskamp (1988, pp. 31–64). This made for a lower cut off score of 26 for both male and female participants. However, gender differences became evident at the beginning of recruitment whereby male participants were scoring lower on the PSS-10 than females. It was for this reason that the cutoff score was adjusted. Studies have reported clear differences between male and female perceived stress scores whereby females on average, report higher levels of perceived stress compared to males (Spacapan & Oskamp, 1988, pp. 31–64). Further studies have found that females report more distress, fear-producing and more stressful experiences compared to males, suggesting that females have a greater tendency to experience negative emotions at a greater frequency and intensity compared to men (Kelly et al., 2008). We found that the initial lower cut off score of 26 only suited females who are more likely to report high stress while excluding males who routinely respond less to interpersonal stressors (Kelly et al., 2008). It was for this reason that the lower cut off score was re-calculated by adding 2 standard deviations to the female mean score and male mean score obtained from Cohen and Williamson's (1988) Perceived Stress Scale validation study (Spacapan & Oskamp, 1988, pp. 31–64). The new lower cut off score to participate in the study was set to 23 for males and 27 for females. The purpose of this study was to examine whether a MBI could be used to help reduce perceived stress in athlete participants. Rejecting male participants who still had reasonably high levels of stress but did not necessarily score 26 seemed to contradict the purpose of the study.

Inclusion to participate in this study was based on the following set inclusion criteria; 1) the participant must compete at a national and/or international level, 2) participants must be older than 18 years old, 3) participants must not have a personal relationship with the primary

researcher and, 4) male participants must score 23 or above on the Perceived Stress Scale (PSS-10) and female participants must score 27 or above on the Perceived Stress Scale (PSS-10).

d. The participant group

Each of the participants were considered high-performance athletes due to their status of competing at a national and/or international level in their chosen sport. Specific details regarding participants name, age and sport cannot be disclosed to preserve anonymity. However, it can be noted that all participants were between the age of 18 and 25 and were training full time, although not currently competing due to COVID-19 restrictions at the time of the study.

Participant one

Participant one was female and scored 27 on her eligibility PSS-10 questionnaire. She was a member of a New Zealand National Team, competing professionally at a national and international level for 1 - 2 years and had practiced meditation in the past.

Participant two

Participant two was male and scored 28 on his eligibility PSS-10 questionnaire. He was not a member of a New Zealand National Team but had been competing at a national level for 3 years and had practiced meditation in the past.

Participant three

Participant three was male and scored 23 on his eligibility PSS-10 questionnaire. He was not a member of a New Zealand National Team but had been competing at a national level for the last 1 - 2 years. He had never practiced meditation before.

5. Measures

a. The Perceived Stress Scale (PSS-10)

The PSS-10 measures the degree to which situations in a person's life are appraised as stressful and is aimed to measure self-appraised stress and the frequency of stressful experiences (i.e., "During the past month, how often have you felt that you were unable to control the important things in your life?"). The PSS-10 consists of 10 items scored on a 4-point Likert scale ranging from 0 (never) and 4 (very often). The PSS-10 aligns with Lazarus and Folkman's (1984) Transactional Model of Stress which suggests that a person's perception of stress is derived from an imbalance between a person's appraisal of situational demands and coping resources (Chiu et al., 2016). The PSS-10 takes less than 5 minutes to complete. PSS-10 scores are calculated by reverse scoring items 4, 5, 7 and 8 followed by the sum of all items. Higher scores indicate greater perceived stress.

A validation study of the PSS with a large sample of American residents found that the 10 item 2 factor version of the PSS was a better measuring tool than the original 14 item PSS, accounting for 48.9% of the variance, with better reliability (Cronbach's α = .84 ~.86). The PSS-10 correlated with anxiety, depression and life events which indicated good construct validity (Spacapan & Oskamp, 1988, pp. 31–64). Validation studies using the PSS with samples of athletes and non-athletes found that the PSS-10 was a better fit model than the original PSS and a useful tool in assessing perceived stress in both sport and non-sport settings. Results across three studies further indicated the PSS-10 had good internal consistency and significant test re-test reliability (r = .66, r = .55). Measurement invariance across athletes and non-athletes positively correlated with athletes' life stress and burnout, and negatively correlated with coping self-efficacy. These findings demonstrated appropriate construct validity and good internal consistency for the 2 factor PSS-10 with Cronbach's alpha of -.81 for perceived stress and .71 for counter stress (Chiu et al., 2016).

b. Acceptance and Action Questionnaire (AAQ-II)

The Acceptance and Action Questionnaire II (AAQ II) is one of the most widely used assessments designed to evaluate the extent to which an individual exhibits experiential avoidance and psychological inflexibility (Hayes et al., 2006). The AAQ-II is derived from an earlier version of the AAQ, known as the AAQ-I. There are a number of versions of the AAQ-I including 9 item and 16 item versions. However, an early validation study of the AAQ-I showed poor internal consistency with an alpha coefficient of a just satisfactory .70, and test

ret est reliability at .64 over four months. The AAQ-I also presented unnecessary item complexity in the wording of each item, making comprehension difficult for individuals who lacked experience in ACT or CBT. The AAQ-II was developed to resolve these problems and be a more stable and psychometrically sound instrument (Bond et a.., 2009).

The AAQ-II is a one factor measure of psychological inflexibility measuring subcomponents of the ACT Hexaflex model including experiential acceptance, cognitive defusion, contact with the present moment, self as context, values committed behaviour and committed action. AAQ-II can be used in settings where time is limited, in a way that is comprehendible to all individuals and can be used in a variety of settings ranging from organisational, performance and clinical settings (Hayes et al., 2013). The AAQ-II consists of 7 negatively worded items, for example, "worries get in the way of my success" and "my painful experiences and memories make it difficult for me to live a life that I would value.". The items are presented on a 7-point Likert scale ranging from 1 as "never true", 4 as "sometimes true" and 7 as "always true". The SCS-SF score is calculated by adding the sum of the seven items, negative items were reverse coded. Higher scores indicate greater levels of psychological inflexibility.

A validation study by Hayes et al. (2013) examined the psychometric properties of the AAQ-II over three studies across six samples with a total of 2,816 participants. The validation study provided promising evidence for adequate structure, reliability, and validity of the AAQ-II. Findings showed good construct validity and internal consistency with a mean alpha coefficient across the six samples of .84. Three and twelve month test retest reliability was .81 and .79. Findings further indicated that the AAQ-II was associated with variables theoretically tied to higher levels of psychological inflexibility, where high levels of psychological inflexibility correlated with depression, anxiety, stress, and overall psychological distress.

c. Mindfulness Attention Awareness Scale (MAAS)

The Mindfulness Attention Awareness Scale (MAAS) is a one-dimensional scale measuring dispositional mindfulness levels, focusing on the presence or absence of attention to, and awareness of what is occurring in the present moment. This is based on the premise that present centred attention and awareness is foundational to mindfulness (Brown & Ryan, 2004).

The MAAS is a 15-item questionnaire that measures the frequency of mindful states in everyday life, using general and situation specific statements such as, "I find myself doing things without paying attention" and "I tend not to notice feelings of physical tension or discomfort until they grab my attention." (Carlson & Brown, 2005). Responses are given on a 6-point scale, ranging from one (almost always) to six (rarely), with higher scores representing greater dispositional mindfulness. The MAAS was written for ages 10 – 11, making it easy to comprehend and therefore useful for a variety of populations and age groups. MAAS scores are calculated as the mean of participants responses across all 15 items; higher scores indicate greater levels of dispositional mindfulness (Brown & Ryan 2003).

There have been multiple studies that have demonstrated the validity for the MAAS. A confirmatory factor analysis of the MAAS with university students (n=727) demonstrated strong internal consistency and reliability (α=0.89) (MacKillop & Anderson, 2007) with no were no gender differences in mindfulness as measured by MAAS. A correlational study by Brown and Ryan (2003) ran a exploratory factor analysis of the MAAS using a sample of university students (N = 327). The results revealed a Cronbach's alpha of .82 suggesting good reliability. The findings also showed that mindfulness is a distinct form of awareness and attention and is associated with a number of wellbeing indicators. Further, the results from the study demonstrated incremental validity in uniquely predicting greater self-awareness and psychological wellbeing above similar constructs in adult samples.

d. Self-Compassion Scale Short Form (SCS-SF)

The original Self-Compassion Scale (SCS) is a 26-item scale measuring six components of self-compassion. The Self-Compassion Scale Short Form (SCS-SF) is a shortened version of the SCS scale and was developed to create a measure of self-compassion that was less time constraining for users and a more economical alternative to the long form SCS (Raes et al., 2011). The SCS SF is a 12-item scale used to measure self-compassion; items are rated on a five-point response scale ranging from 1 (almost never) to 5 (almost always). The SCS-SF assesses six components of self-compassion (e.g., "When I'm going through a very hard time, I give myself the caring and tenderness I need"), self-judgment (e.g., "I'm disapproving and judgmental about my own flaws and inadequacies"), and common humanity (e.g., "I try to see my failings as part of the human condition.", isolation (e.g., "When I fail at

something that's important to me, I tend to feel alone in my failure"), mindfulness (e.g., "When something upsets me I try to keep my emotions in balance"), and over-identification (e.g., When I'm feeling down I tend to obsess and fixate on everything that's wrong"). The total score is calculated by reversing the score of negative subscale items, calculating the score sum of the 12 items and computing the total mean; higher scores indicate greater self-compassion (Raes et al., 2011).

Evidence for the validity of the SCS has shown good construct validity and test-re-test reliability. A correlational study with undergraduate students showed high levels of self-compassion were linked to psychological wellbeing (Neff, 2003). Validation studies of SCS-SF with three large samples of university students showed good internal consistency with Cronbach's alpha of 0.86 in all samples as well as almost perfect correlation with the original SCS ($r \geq 0.97$ all samples). Cronbach's alphas for subscales of the SCS-SF ranged from 0.54 to 0.75. The authors recommended using the SCS if information about subscales is crucial, otherwise, the findings demonstrated the SCS-SF as a reliable and valid alternative to the SCS, particularly when assessing overall self-compassion scores (Raes et al., 2011).

6. Study Protocol

The study consisted of three repeated baseline measures, two mid intervention measures and four post-intervention measures. The mindfulness psychoeducation component of the study was a 25-minute pre-recorded video delivering education around mindfulness and associated benefits as well as information on the meditation smartphone application to be used. The psychoeducation session was delivered the day before the start of the meditation component of the intervention.

The meditation component of the intervention marked day one of the intervention and started one day after psychoeducation session. The meditation component of the study was delivered via a smartphone application called '1 Giant Mind - Learn to Meditate'. The app consisted of 12 days of learning to meditate followed by a 30-day challenge where participants were encouraged to practice meditation once a day, every day for a total of 42 days. Due to a mistake in data collection, the intervention went for a total of 30 days as opposed to 42 days. As such, participants participated in 12 days of learning to meditate, followed by 18 days of

meditation. It is important to note that during the 12 days of learning, participants were still meditating once a day. As such, the meditation component of intervention included a total of 30 days of meditation. A methodology flow diagram can be referred to in Appendix L.

a. Baseline

Baseline measures were repeated weekly for a minimum of three weeks to minimise deviating values. A baseline is a period in which target behaviours are observed repeatedly and is necessary period for SCD. Baseline measures demonstrate the stability of self-reports before the intervention so that the effects of the intervention can be evaluated against the natural occurrence of behaviour or in this case, self-reported of perceived stress, psychological inflexbility, dispositional mindfulness and self-compassion pre-intervention. Baseline periods allow a researcher to address and measure changes after the intervention. A stable baseline pattern must be present to assess whether the intervention is responsible for any changes in the self-report after initiation of the intervention. If the baseline pattern is not stable, reported changes may be less compelling because self-reports were already changing during the baseline period (Gallo et al., 2013).

In this study, baseline testing occurred once a week for three or more weeks before intervention onset. Participants were required to fill out the Perceived Stress Scale (PSS-10), Acceptance and Action Questionnaire (AAQ-II), Mindfulness Attention Awareness Scale (MAAS) and Self-Compassion Scale Short Form (SCS-SF) every seven days for at least three weeks. In some cases, participants were required to fill out an additional week or two of baseline testing to achieve a stable baseline pattern. Once a stable baseline pattern was established, participants were able to begin the mindfulness intervention.

b. Mid intervention testing

Participants were required to fill out the PSS-10, MAAS, AAQ-II and SCS-SF on day 14 and day 28 of the intervention. These were administered to test for any changes that occurred during the intervention.

c. Post intervention testing

After the intervention, each participant completed the PSS-10, MAAS, AAQ-II and SCS-SF once a week for three weeks to assess the effectiveness of the intervention. Participants were informed via email on day 30 that the intervention period was complete, and that if they wished to keep using meditation app then they could do so. The first week of post-intervention testing was administered five days following the end of the intervention (day 35).

d. Post intervention follow-up survey

Once post-intervention testing results were collected, participants were asked to fill out a survey to assess their use of the meditation app, perceived helpfulness and challenges of the intervention, and to see if participants would continue to use meditation. A copy of the follow up survey can be viewed in Appendix J.

7. Mindfulness Psychoeducation and Meditation Intervention

The intervention consisted of one mindfulness psychoeducation session delivered via video followed by thirty days of meditation using the 1 Giant Mind – Learn to Meditate smartphone application. Mindfulness psychoeducation was used based on evidence which has suggested that psychoeducation improves athletes' understanding of and engagement with MBIs (Baltzell et al., 2014; Scott-Hamilton et al., 2016). Research has indicated smartphone meditation based applications to be helpful when it comes to decreasing stress (Huberty et al., 2019; Flett et al., 2019), enhancing dispositional mindfulness (Wen et al., 2017), and promoting regular mindfulness and meditation engagement and practice in populations who may be time poor (Hendrick et al., 2020).

a. Mindfulness Psychoeducation

Participants were emailed a 25-minute-long video Mindfulness Psychoeducation video that was conducted and recorded by the primary researcher. The structure of the video was adapted from Gardner and Moore's (2007) Mindfulness Acceptance Commitment Therapy psychoeducation module one. The content delivered via the video was evidence based and aimed to educate participants on the science and mechanisms of mindfulness and meditation, on the specific benefits related to individual well-being and performance outcomes, and to introduce the 1 Giant Mind meditation app and reiterate the study procedure. This use of

psychoeducation is based on evidence that has suggested psychoeducation may aid athlete adherence to MBIs, particularly when it comes to at home meditation practice (Hendricks et al., 2019; Scott-Hamilton et al., 2016). The information in the psychoeducation video was delivered in layman's terms so participants could fully comprehend the content of the video. The full transcript of the video is given in Appendix K.

b. The 1 Giant Mind – Learn to Meditate smartphone application

The meditation component of the mindfulness intervention was administered using '1 Giant Mind - Learn to Meditate' smartphone application. The 1 Giant Mind Technique is an Automated Self-Transcending meditative technique that uses an sound without meaning in the form of a mantra to trigger the mind to settle into quitter levels of thought until it achieves a state of consciousness where thought it not the centre of attention. Although deep, this type of meditation is a simple, effortless technique that allows the mind to effortlessly transcend into a state of restful alertness (Travis & Parim, 2017).

The 1 Giant Mind – Learn to Meditate phone application was selected for this study for a number of reasons. First, the 1 Giant Mind technique is an Automated Self-Transcending technique. Although there have been no published studies on the effects of the 1 Giant Mind application, evidence has suggested that Automated Self-Transcending techniques such as Transcendental Meditation, are effective at reducing anxiety (Orme-Johnson & Barnes, 2014) and stress (Travis et al., 2009; Dillbeck & Orme-Johnson, 1987).

Second, Transcendental Meditation is unique to other meditative techniques in that is elicits EEG alpha wave coherence and brain integration (Travis & Shear, 2010) whereby Transcendental Meditators have shown greater brain coherence and alpha wave activity than non-meditators (Travis et al. 2009). The benefits of enhanced brain have been demonstrated in studies with athletes who have shown greater brain coherence than non-elite athletes. This was associated with enhanced habituation to stress, peak performance, self-development and moral reasoning. Brain coherence has correlated with a greater emotional stability, moral reasoning and decreased anxiety (Harung et al., 2009).

Third, the 1 Giant Mind application was used based on its effortless, easy technique. A majority of published studies using meditation applications have used applications which promote Task Focused Meditation (e.g., Headspace and Calm) (Wen et al., 2017; Bostock et al., 2019; Huberty et al., 2019; Flett et al., 2019). Task Focused meditative techniques require more mental effort than Automated Self-Transcendental Meditative techniques and can therefore be challenging for novice meditators (Lutz et al., 2009; Lumma et al., 2015).

Finally, there are many studies on the effects of Task Focused Meditative phone applications but there have been no studies on Automated Self Transcendental meditative techniques using phone applications. It was therefore of interest to investigate how Automated Self Transcending meditative phone application could be helpful to high performance athletes experiencing high levels of stress.

Following the mindfulness psychoeducation session, participants started twelve days of learning to meditate using the 1 Giant Mind phone application. This included practicing meditation for fifteen minutes every day. This was followed by eighteen days of practicing meditation as part of a 30-day challenge, which gave participants the option to meditate daily for ten, fifteen or twenty minutes. The intervention was originally supposed to run for 42 days, but due to a mistake in data collection, the app intervention was concluded at 30 days.

The 1 Giant Mind app gave participants the option to complete the twelve days of learning in three hours over one day or a few days. However, participants were instructed to complete one lesson once a day over twelve days. Each of the twelve steps was fifteen minutes duration and scaffolded upon what was learned in the previous step. Each step included educating participants on core components of the 1 Giant Mind meditation technique such as processes of awareness and acceptance. This procedure further reinforced the importance of psychoeducation when it comes to engaging with and benefiting from meditation interventions (Baer et al., 2019). Included in the 12 days of learning was 10 to 20 minutes of meditation per day. At the end of the twelve-steps, participants had learned a meditation technique to practice anywhere at any time with or without guidance.

For the thirty-day challenge, participants were given the option of using their preferred variable timer, whereby participants could choose to meditate with male or female guidance,

with music or in silence, and with options ranging from ten, fifteen and twenty minutes. The 1 Giant Mind app included easy to follow introduction videos as well as access to a 'review your experience' video tutorial library aimed to deepen participants' knowledge of the 1 Giant Mind meditation technique. The app included a journal to keep track of meditation experiences as well as reminder tools to help participants stick with their meditation practice. The app also gave participants access to articles and videos aimed at deepening participants' understanding of their meditation practice and associated benefits. Participants' use of these additional components were optional.

Participants used the app for a total of thirty days, and they were encouraged to meditate once a day. The participants could choose when they meditated and if they meditated for ten, fifteen, or twenty minutes. Participants were contacted by the primary researcher via text once a week to encourage daily practice and to answer any questions or concerns around their involvement in the study.

8. Data analysis

Individual data were graphed using Microsoft Excel and then analysed using visual analysis. Trend lines were added to assist in describing the data set. Individual data were graphed using Line graphs and Brinley plots to show changes in perceived stress, psychology inflexibility, dispositional mindfulness and self-compassion from baseline to mid and post-intervention. Brinley plots are useful for detecting any changes because of interventions, especially with a small sample, as in the current study. Baseline scores were plotted on the x-axis and post-intervention scores were plotted on the y-axis. If scores were maintained post-intervention the data points would lie close to the 45° line. An increase in scores was shown by data points lying above the 45° line, a decrease in scores were shown by data points lying below the 45° line (Brinley, 1965).

Percentage of Nonoverlapping Data (PND) statistic was calculated to measure the effect size (Scruggs, Mastropieri, & Casto, 1987). The PND statistic is the percentage of post-intervention data that is more extreme than the single most extreme point of data at baseline (Scruggs et al., 1987). In this study, the single most extreme data point at baseline testing was each participant's lowest baseline perceived stress (PSS-10) and psychological inflexibility

(AAQ-II score, and highest dispositional mindfulness (MAAS) and self-compassion (SCS-SF) score. The PND statistic represents the proportion of observations that exceed any changes during baseline testing (Scruggs et al., 1987). To calculate the PND statistic, the most extreme point of the baseline data was identified. The number of points that fell above the line were counted, divided by the total number of assessment points and multiplied by 100. This captured the percentage of data points that were not overlapping the extreme baseline data point. PND scores below 50% suggested the intervention was ineffective, scores between 50% and 70% suggested moderate effectiveness of the intervention, scores between 70% and 90% suggested the intervention was effective, and scores over 90% suggested that the intervention very effective (Scruggs & Mastropieri, 1998).

The Standardised Mean Difference (SMD) for each participant was also calculated to measure individual effect size. The SMD expresses the size of the intervention effect for each participant across all four measures and was calculated using the following formula (Faraone, 2008; Higgins & Green, 2011).

$$SMD = \frac{individual\ post\ \mu - individual\ baseline\ \mu}{individual\ baseline\ \sigma x}$$

In addition to analysing individual data, data was analysed at a group-level to provide further insight into intervention outcomes. Self-report measures were further analysed using Standard Mean Difference All (SMDall) to test the efficacy of the intervention on perceived stress, psychological inflexibility, dispositional mindfulness, and self-compassion at a group level. The SMDall is an effect size calculation of all baseline and intervention data points (Olive & Smith, 2005). To calculate SMDall, the mean intervention and post-intervention score is subtracted from the mean baseline and then divided by the standard deviation of baseline.

$$SMDall = \frac{overall\ post\ \mu - overall\ baseline\ \mu}{overall\ baseline\ \sigma x}$$

For measures of stress and psychological inflexibility, a negative SMD and SMDall number represented superiority of the intervention over baseline measures as the PSS-10 and AAQ-II scale is negatively orientated. Improvements were associated with lower scores in PSS-10 and AAQ-II measures, where SMD and SMDall < 0 indicated the degree to which the intervention was more effective. For measures of mindfulness and self-compassion, a positive number represented the superiority of the intervention over baseline measures as the MAAS and SCS-SF scale is positively orientated. Improvements were associated with higher scores in MAAS and SCS-SF measures, and SMD and SMDall > 0 indicated the degree to which the intervention was more effective. The guideline used for interpreting the magnitude of SMD and SMDall statistics suggested that a small effect = 0.2, medium effective = 0.5 and large effective = 0.8 (Faraone, 2008).

Chapter Four Results

Key information emerged in regard to the effect of the current studies mindfulness psychoeducation and meditation intervention to decrease stress. Baseline and post-intervention results reported changes in (1) perceived stress, (2) dispositional mindfulness, (3) self-compassion and, (4) psychological inflexibility. Each of these areas are discussed in the sections below alongside graphs and tables displaying the appropriate data.

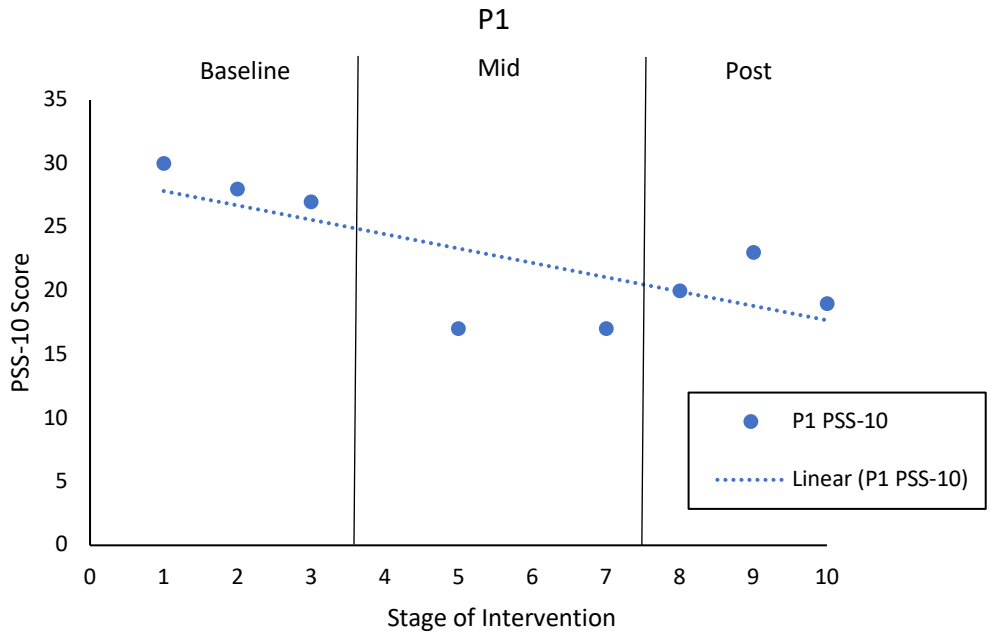
1. Effects of the Intervention on Perceived Stress (PSS-10)

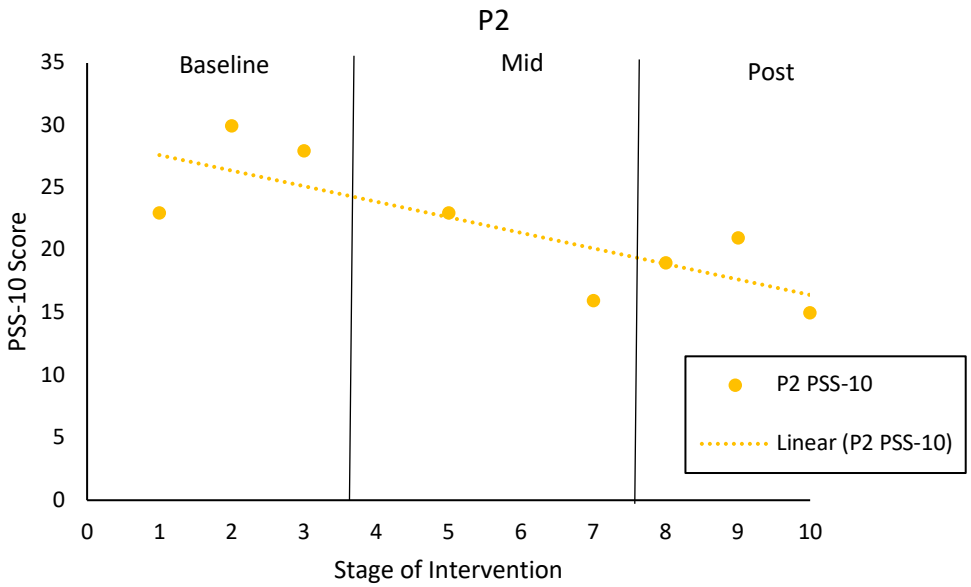
Changes in individual perceived stress scores following the three stages of the intervention are displayed in Figure 5. The data is presented in the way that intervention stage one to three on the graph's x-axis for P1 and P2 corresponds to baseline testing once a week for three weeks. Intervention stage one to five on the graph's x-axis for P3 corresponds to baseline testing once a week for five weeks. Intervention stage four and five on the graph's x-axis for P1 and P2 corresponds to mid intervention testing at week two and week four of the intervention. Intervention stage six and seven on the graph's x-axis for P3 corresponds to mid intervention testing at week two and week four of the intervention. Intervention stage six to eight on the graph's x-axis for P1 and P2 corresponds to post intervention testing once a week for three weeks following the end of the thirty-day intervention. Intervention stage eight to ten on the graph's x-axis for P3 corresponds to post intervention testing once a week for three weeks following the end of the thirty-day intervention.

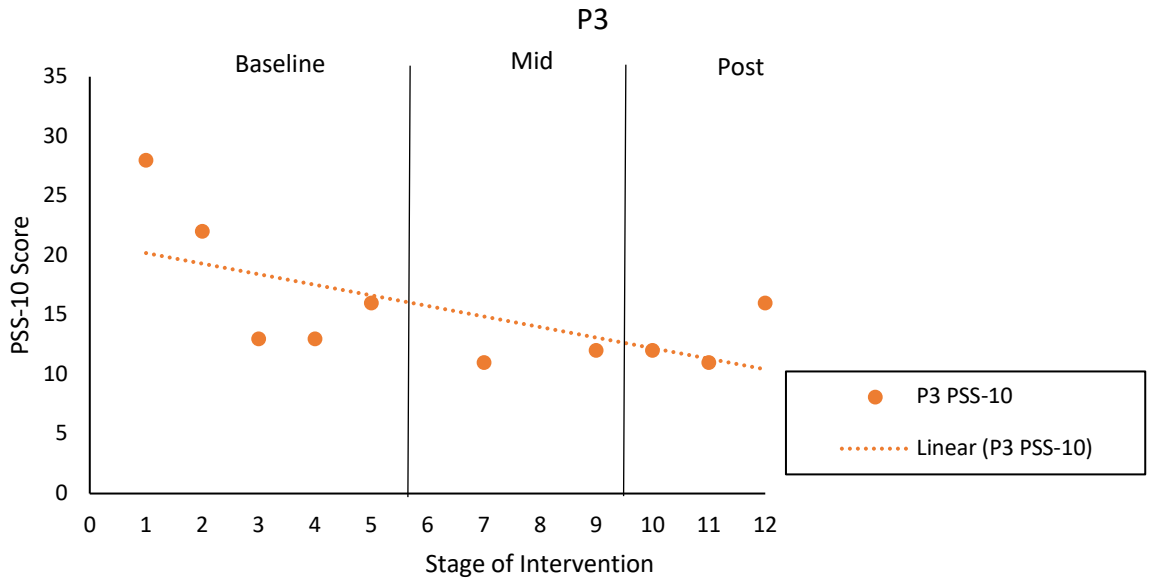
Based on visual interpretation of the data of Figure 5, it appears that P1 and P2 maintained stable baseline perceived stress scores over the three weeks. P3 was required to take an additional two weeks of baseline testing due to a large decrease in perceived scores from weeks one to week three of baseline testing. P3's baseline perceived scores stabilised over weeks three to week five of baseline testing. There was a decrease in individual perceived stress scores from baseline to mid intervention and a slight increase in individual perceived scores from mid intervention to post intervention for all three participants. Mean post intervention perceived scores remained lower than mean baseline perceived scores for all three participants.

Figure 5

Perceived stress (PSS-10) scores for all three participants calculated at baseline, mid and post intervention testing.







Note. Participant three was required to take an additional two weeks of baseline testing due to a large decrease in Perceived Stress scores from week two to week three. This was as to maintain stable baseline scores for the purpose of within subject comparison in scores from baseline to post-intervention.

All three participants showed reductions in their mean perceived stress scores from baseline to post intervention as can be seen below in Table 1, suggesting an overall decrease of perceived stress throughout the intervention. Percentage of Nonoverlapping Data (PND) were calculated to determine effect size. The PND statistics presented in Table 1 indicate a decrease in perceived stress across all three participants. The effect of the intervention was considered very effective for decreasing perceived stress for P1 (PND = 100%) and effective for P2 (PND = 80%), and P3 (PND = 80%). Individual Standardised Mean Difference (SMD) is also displayed in Table 1 to determine individual effect size. The intervention showed a large effect size for all three participants as denoted by the large SMD values. SMD for P1 = 6.15, P2 = -2.94, and P3 = -0.93. The SMDall statistic is also displayed on Table 1 and suggests that the intervention had a large effect at a group level (SMDall = - 0.93).

Table 1

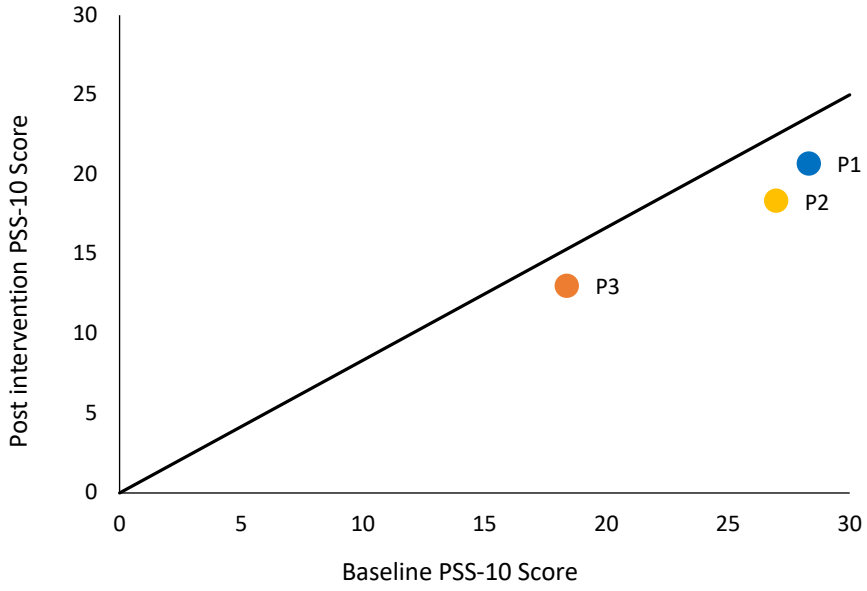
Individual Perceived Stress (PSS-10) scores for all three participants from baseline, mid and post intervention testing with calculated Standardised Mean Difference (SMD), Standardised Mean Difference All (SMDall) and Percentage of Non-overlapping Data (PND) statistics.

	Participants			
	P1	**P2**	**P3**	
Baseline	30	23	28	
	28	30	22	
	27	28	13	
			13	
			16	
Mid	17	23	11	
	17	16	12	
Post	20	19	12	
	23	21	11	
	19	15	16	
PND	100%	80%	80%	
SMD	-6.15	2.94	0.93	
SMDall				-0.93

Displayed in Figure 6 is a Brinley plot comparing each participant's mean PSS-10 score at baseline and post intervention phases. Each of the three participants mean perceived stress scores from baseline and post intervention testing sit below the line of no change which has been used to compare pre and post intervention data (Blambied, 2017). This indicates a sustained decrease in perceived stress scores throughout the study.

Figure 6.

Brinley plot comparing participants mean perceived stress (PSS-10) scores from baseline to post intervention testing.



2. Effects of the Intervention of Psychological Inflexibility (AAQ-II)

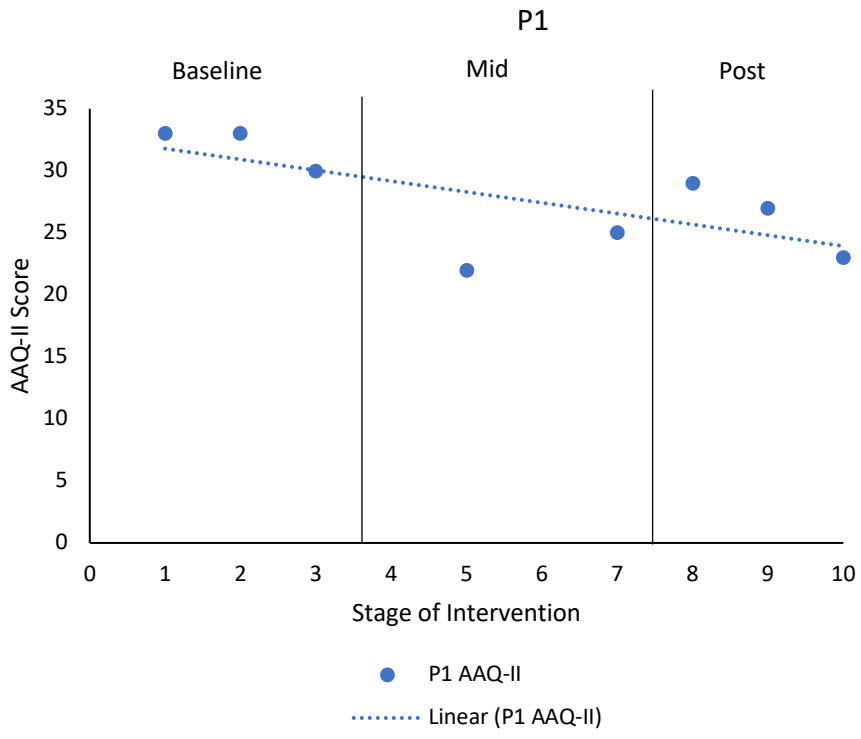
Changes in individual psychological inflexibility scores following the three stages of the intervention are displayed in Figure 7. The data is presented in the way that intervention stage one to three on the graph's x-axis for P1 and P2 corresponds to baseline testing once a week for three weeks. Intervention stage one to five on the graph's x-axis for P3 corresponds to baseline testing once a week for five weeks. Intervention stage four and five on the graph's x-axis for P1 and P2 corresponds to mid intervention testing at week two and week four of the

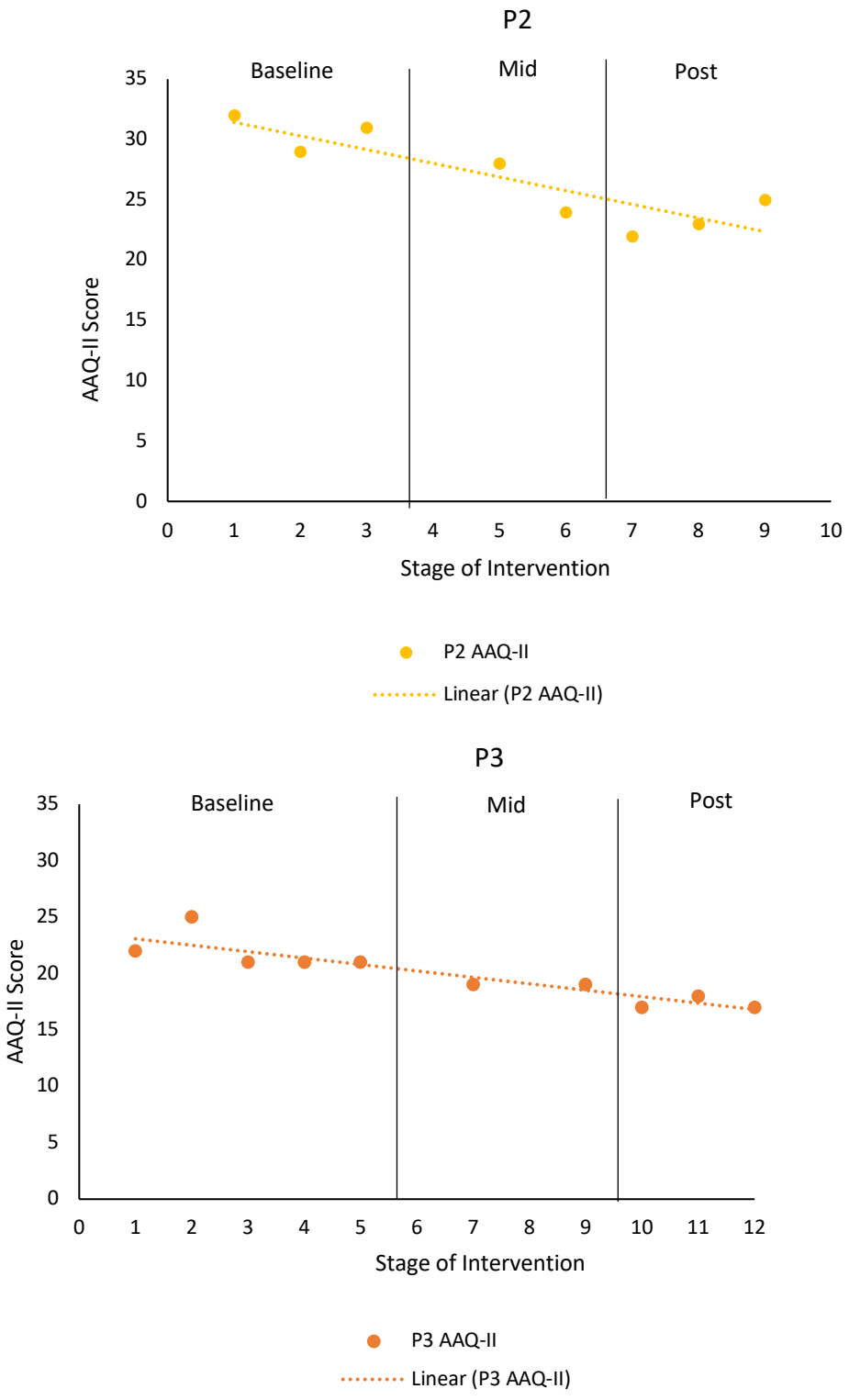
intervention. Intervention stage six and seven on the graph's x-axis for P3 corresponds to mid intervention testing at week two and week four of the intervention. Intervention stage six to eight on the graph's x-axis for P1 and P2 corresponds to post intervention testing once a week for three weeks following the end of the thirty-day intervention. Intervention stage eight to ten on the graph's x-axis for P3 corresponds to post intervention testing once a week for three weeks following the end of the thirty-day intervention.

Based on the visual interpretation of the data, it appears that all three participants maintained stable baseline AAQ-II scores over the baseline testing period. As seen in Figure 5, there was a decrease in individual psychological inflexibility scores from baseline to mid intervention for all three participants, and a continued decrease in psychological inflexibility scores from mid to post intervention for P2 and P3. There was an increase from mid to post intervention psychological inflexibility scores from P1.

Figure 7

Individual psychological inflexibility scores (AAQ-II) for all three participants calculated at baseline, mid- and post- intervention testing.





Note. Participant three was required to take an additional two weeks of baseline testing due to a large decrease in perceived stress scores from week two to week three. This was to maintain stable baseline scores for the purpose of within subject comparison in scores from baseline to post-intervention.

Individual post intervention psychological inflexibility scores remained lower than baseline scores for all three participants, as seen in table Table 3. There was an overall decrease in psychological inflexibility throughout the intervention. Percentage of Nonoverlapping Data (PND) was calculated to determine effect size. The PND statistics presented in Table 3 indicate a decrease in psychological inflexibility across all three participants. The intervention was considered very effective for decreasing psychological inflexibility where PNS for P1 = 100%; P2 = 100% and and P3 = 100%). Individual Standardised Mean Difference (SMD) is also displayed on Table 3 to determine individual effect size. The effect of the intervention was considered very effective for decreasing psychological inflexibility for P1 (PND = 100%), P2 (PND = 100%) and P3 (PND = 100%). The intervention showed a large effect size for P2 and P3 as denoted by the large SMD values; SMD for P2(-1.25) and P3 (-2.69). The intervention showed small effect for P1 as denoted by the small SMD value P1 (-0.44). The SMDall statistic was also displayed on Table 3, indicating that the intervention had a large effect at a group level (SMDall = -0.93).

Table 2

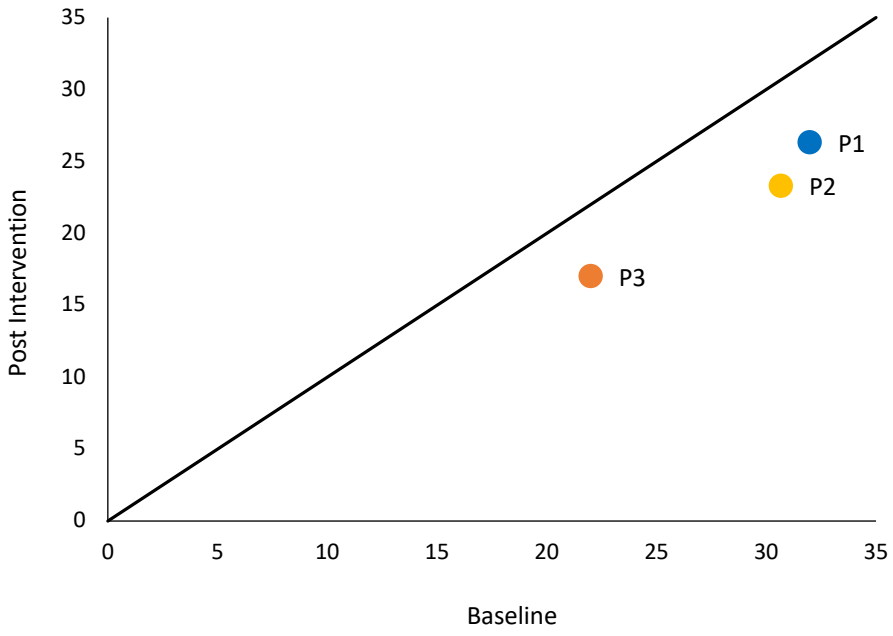
Individual psychological inflexibility (AAQ-II) scores for all three participants from baseline, mid and post intervention testing with calculated Standardised Mean Difference (SMD), Standardised Mean Difference All (SMDall) and Percentage of Non-overlapping Data (PND) statistics.

	Participants			
	P1	**P2**	**P3**	
Baseline	33	32	22	
	33	29	25	
	30	31	21	
			21	
			21	
Mid	22	28	19	
	25	24	19	
Post	29	22	17	
	27	23	18	
	23	25	17	
PND	100%	100%	100%	
SMD	-0.43	-1.25	-2.69	
SMDall				-0.92

Displayed in Figure 8 is a Brinley plot comparing each participant's mean psychological inflexibility score from baseline to post intervention. The plot indicates decreased psychological inflexibility for all three participants from baseline to post intervention. Each of the three participants mean psychological inflexibility scores from baseline and post intervention testing sit below the line of no change. This indicates a sustained decrease in psychological inflexibility throughout the study.

Figure 8

Brinley plot comparing participants mean psychological scores (AAQ-II) from baseline to post intervention testing.



3. Effects of the Intervention on Dispositional Mindfulness (MAAS)

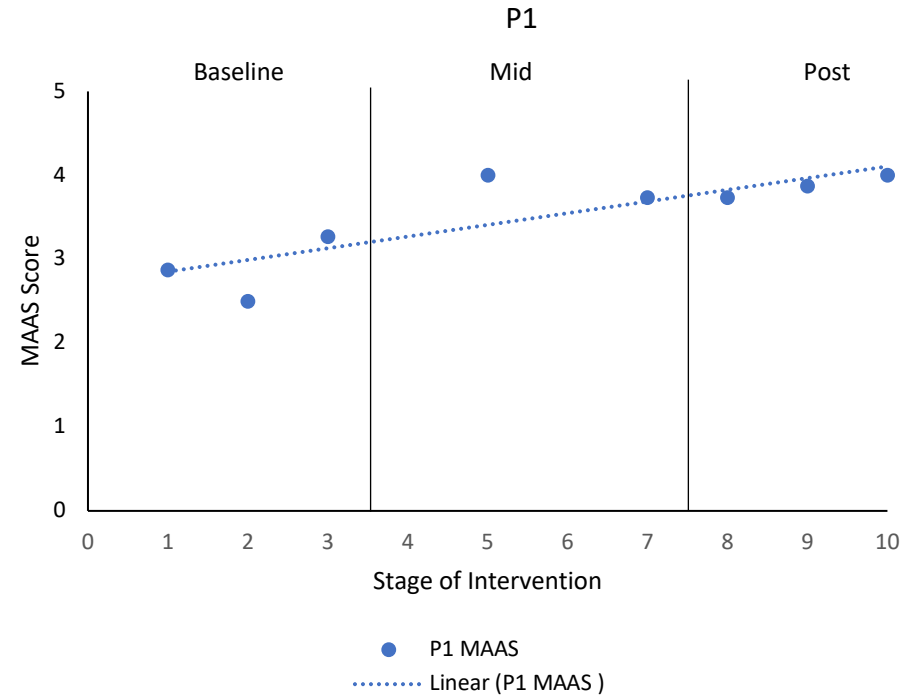
Changes in individual mindfulness scores following the three stages of the intervention are displayed in Figure 9. The data is presented in a way in which intervention stage one to three on the graph's x-axis for P1 and P2 corresponds to baseline testing once a week for three weeks. Intervention stage one to five on the graph's x-axis for P3 corresponds to baseline

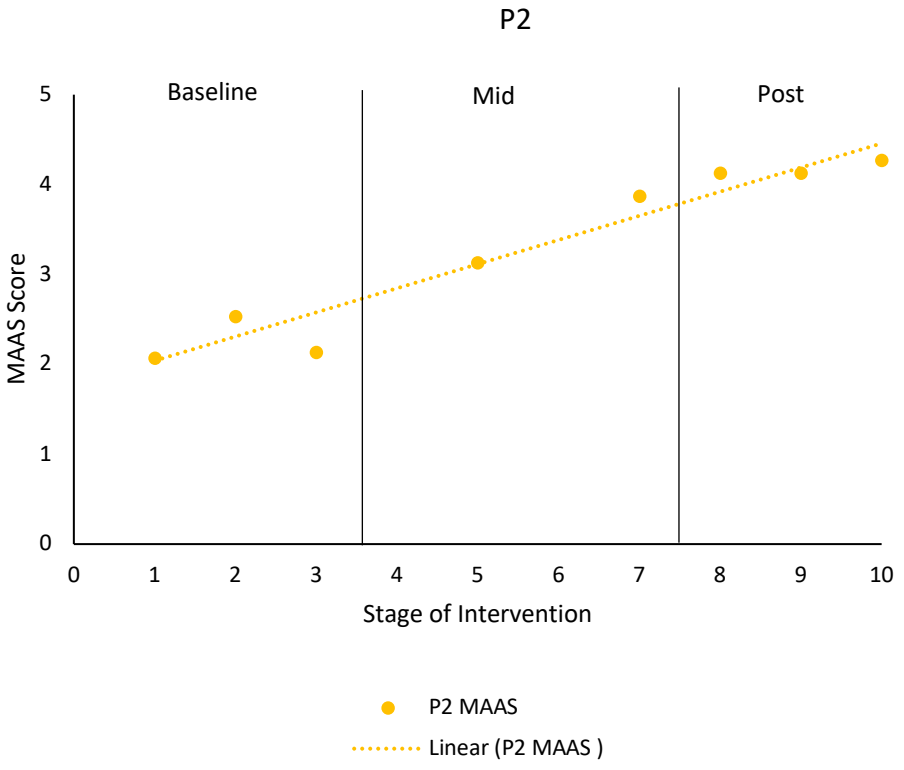
testing once a week for five weeks. Intervention stage four and five on the graph's x-axis for P1 and P2 corresponds to mid intervention testing at week two and week four of the intervention. Intervention stage six and seven on the graph's x-axis for P3 corresponds to mid intervention testing at week two and week four of the intervention. Intervention stage six to eight on the graph's x-axis for P1 and P2 corresponds to post intervention testing once a week for three weeks following the end of the thirty-day intervention. Intervention stage eight to ten on the graph's x-axis for P3 corresponds to post intervention testing once a week for three weeks following the end of the thirty-day intervention.

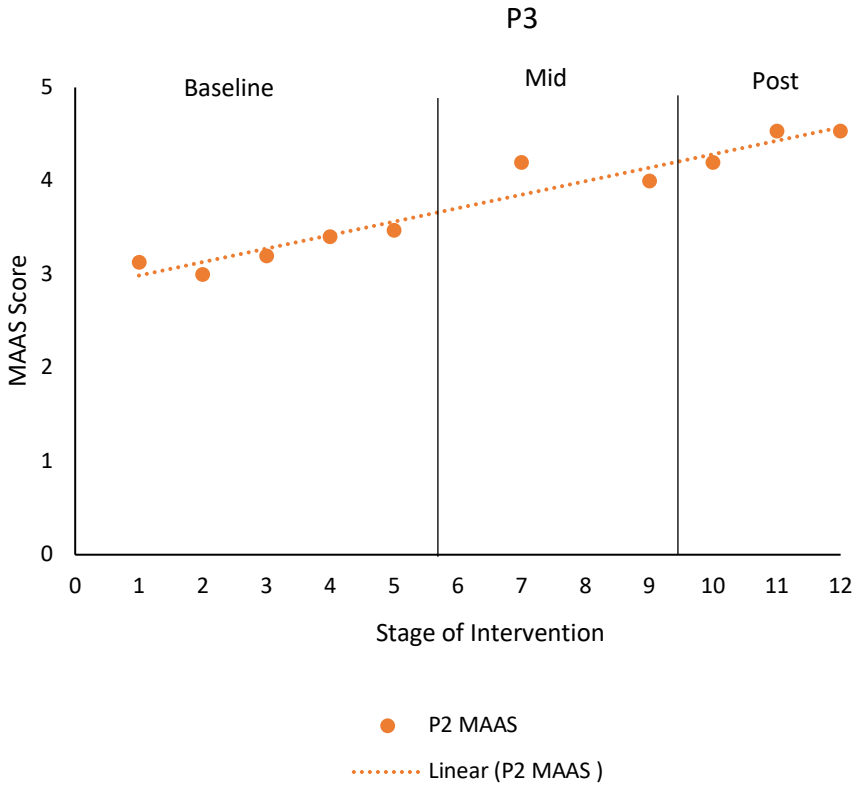
Based on the visual interpretation of the data, it appears that all three participants maintained stable baseline mindfulness scores over the baseline testing period. As seen in Figure 9, there was an increase in mean mindfulness scores from baseline to mid intervention which continued to increase from mid to post intervention for all three participants. Participants mean post intervention mindfulness scores remained greater than mean baseline scores for all three participants.

Figure 9

Dispositional mindfulness (MAAS) scores for all three participants calculated at baseline, mid and post intervention testing.







All three participants showed an increase in their mean mindfulness scores from baseline to post intervention. Mid and post intervention mean mindfulness scores remained the same for P1, and continued to increase for P2 and P3 can be seen below in Table 2. Percentage of Nonoverlapping Data (PND) was calculated to determine effect size. The PND statistics presented in Table 2 indicate an increase in dispositional mindfulness across all three participants. The effect of the intervention was considered very effective for increasing dispositional mindfulness for P1 (PND = 100%), P2 (PND = 100%) and P3 (PND = 100%). Individual Standardised Mean Difference (SMD) is also displayed on Table 2 to determine individual effect size. The intervention showed a large effect size for all three participants as denoted by the large SMD values i.e., SMD for P1(2.56); P2(7.73); and P3 (-6.1). The SMDall statistic was also displayed on Table 2, and suggested that the intervention had a large effect at a group level (SMDall = 2.6).

Table 3

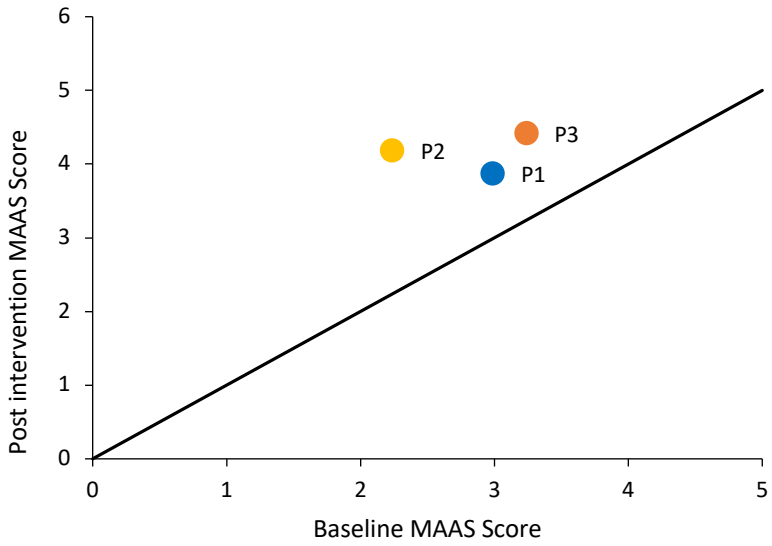
Individual Dispositional Mindfulness (MAAS) scores for all three participants from baseline, mid and post intervention testing with calculated Standardised Mean Difference (SMD), Standardised Mean Difference All (SMDall) and Percentage of Non-overlapping Data (PND) statistics.

	Participants			
	P1	**P2**	**P3**	
Baseline	2.87	2.07	3.13	
	2.5	2.53	3	
	3.27	2.13	3.2	
			3.4	
			3.47	
Mid	4	3.13	4.2	
	3.73	3.87	4	
Post	3.73	4.13	4.2	
	3.87	4.13	4.53	
	4	4.27	4.53	
PND	100%	100%	100%	
SMD	2.6	7.7	6.1	
SMDall				2.6

Displayed in Figure 10 is a Brinley plot comparing each participant's mean mindfulness scores at baseline and post intervention testing. The plot indicates increased dispositional mindfulness for all three participants post intervention. Each of the three participants mean mindfulness scores from baseline and post intervention testing sit above the line of no change. This indicates a sustained increase in mindfulness scores throughout the study.

Figure 10

Brinley plot comparing participants mean dispositional mindfulness scores (MAAS) from baseline to post intervention testing.



4. Effects of the Intervention on Self-Compassion (SC-SF)

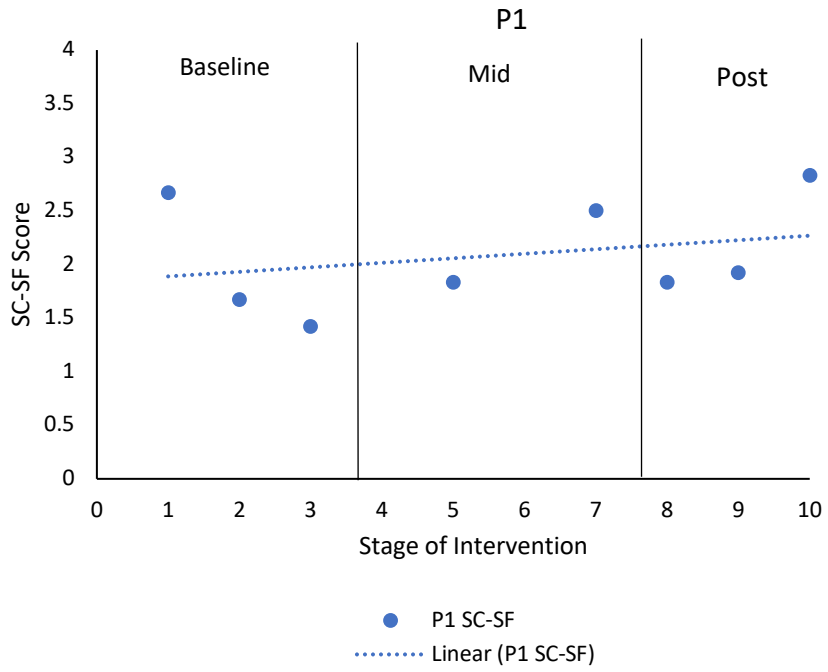
Changes individual self-compassion scores following the three stages of the intervention are displayed in Figure 11. The data is presented in the way that intervention stage one to three on the graph's x-axis for P1 and P2 corresponds to baseline testing once a week for three weeks. Intervention stage one to five on graph's x-axis for P3 corresponds to baseline testing once a week for five weeks. Intervention stage four and five on the graph's x-axis for

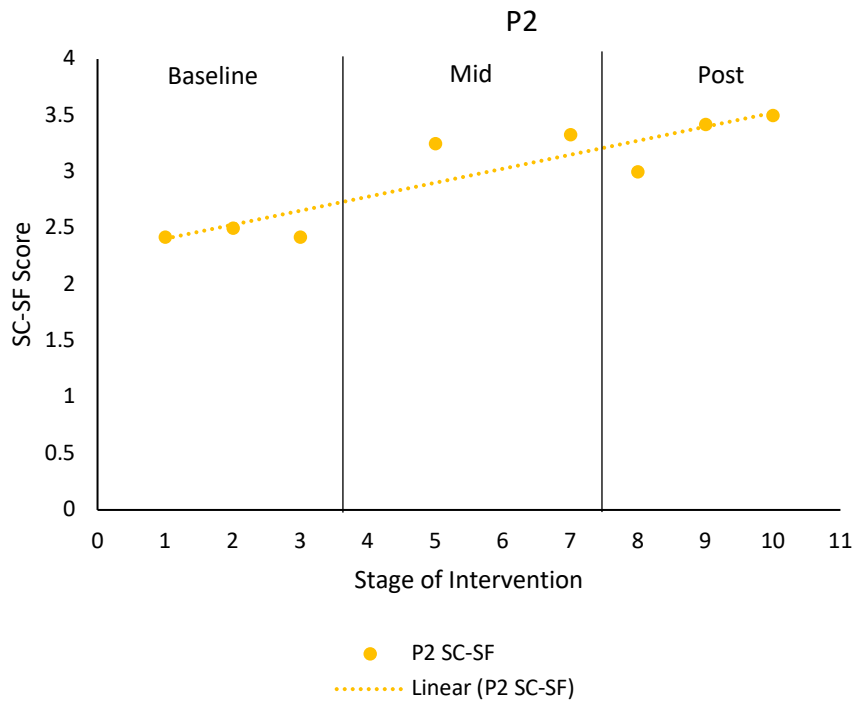
P1 and P2 corresponds to mid intervention testing at week two and week four of the intervention. Intervention stage six and seven on the graph's x-axis for P3 corresponds to mid intervention testing at week two and week four of the intervention. Intervention stage six to eight on the graph's x-axis for P1 and P2 corresponds to post intervention testing once a week for three weeks following the end of the thirty-day intervention. Intervention stage eight to ten on the graph's x-axis for P3 corresponds to post intervention testing once a week for three weeks following the end of the thirty-day intervention.

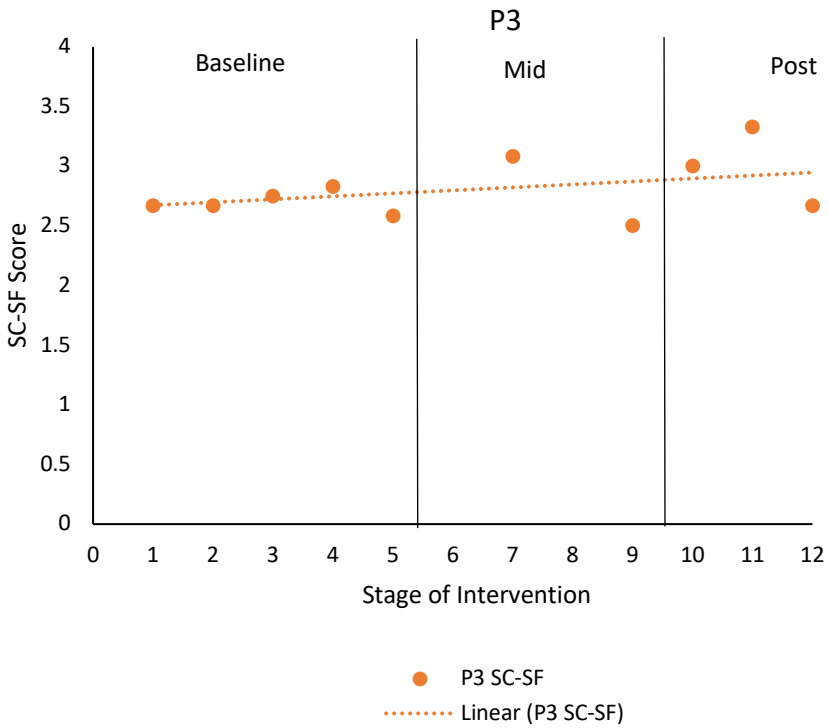
Based on the visual interpretation of the data, it appears that all three participants maintained stable baseline self-compassion scores over the baseline testing period. As seen in Figure 11, there was an increase in individual self-compassion scores from baseline to mid intervention and only a very slight increase in individual self-compassion scores from mid intervention to post intervention for all three participants. Individual post intervention self-compassion scores remained greater than baseline SC-SF scores for all three participants.

Figure 11

Individual self-compassion scores (SC-SF) scores for all three participants calculated at baseline, mid- and post-intervention testing.







All three participants showed an increase in mean self-compassion scores from baseline to mid intervention, an increase from mid- to post- intervention testing, and an

increase from baseline to post intervention, as can be seen in Table 4. There was an overall increase in self-compassion throughout the intervention. PND was calculated to determine effect size. The PND statistics presented in Table 4 indicate an increase in self-compassion across all three participants. The intervention was considered ineffective for reducing self-compassion in P1 (PND = 20%), very effective for P2 (PND = 100%) and moderately effective for P3 (PND = 60%). Individual Standardised Mean Difference (SMD) is also displayed on Table 4 to determine individual effect size. The intervention showed a small effect size for P1 as denoted by the small SMD value where P1 = 0.41, and a large effect size for P2 and P3 as denoted by the large SMD values where SMD for P2 = 18.62. and P3 = 3.18. The SMDall statistic was also displayed on Table 4, further suggesting that the intervention had a large effect at a group level (SMDall = 0.91).

Table 4

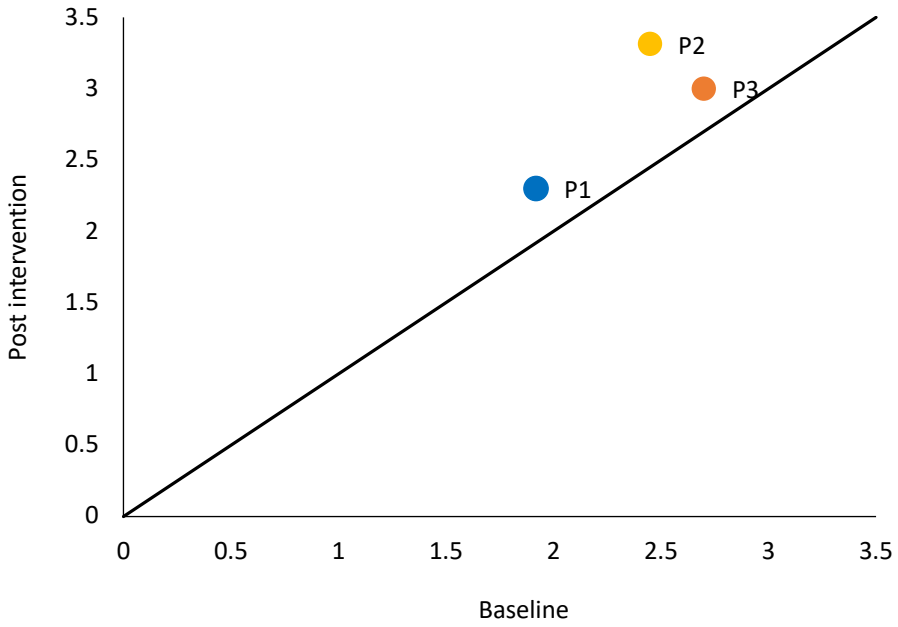
Individual self-compassion (SC-SF) scores for all three participants from baseline, mid and post intervention testing with calculated Standardised Mean Difference (SMD), Standardised Mean Difference All (SMDall) and Percentage of Non-overlapping Data (PND) statistics.

	Participants			
	P1	**P2**	**P3**	
Baseline	2.67	2.42	2.67	
	1.67	2.5	2.67	
	1.42	2.42	2.75	
			2.83	
			2.58	
Mid	1.83	3.25	3.08	
	2.5	3.33	2.5	
Post	1.83	3	3	
	1.92	3.42	3.3	
	2.83	3.5	2.67	
PND	20%	100%	60%	
SMD	0.41	18.62	3.18	
SMDall				0.92

Displayed in Figure 12 is a Brinley plot comparing each participant's mean self-compassion score at baseline to post intervention. The plot indicates increased self-compassion for all three participants post intervention. Each of the three participants mean self-compassion scores from baseline and post intervention testing sit above the line of no change. This indicates a sustained increase in self-compassion scores throughout the study.

Figure 12

Brinley plot comparing participants mean self-compassion scores (SC-SF) from baseline to post intervention testing.



5. Summary of Results

Baseline to post intervention changes were found across all three participants. Perceived stress scores decreased for all participants from baseline to post intervention. Psychological inflexibility scores (AAQ-II) decreased for all participants from baseline to post intervention. Dispositional mindfulness scores (MAAS) increased for all participants from baseline to post intervention. Self-compassion (SC-SF) increased for all participants from baseline to post intervention.

Chapter Five Discussion

1. General discussion

The purpose of this pilot study was to test whether mindfulness psychoeducation and meditation using a smartphone application can successfully decrease stress and psychological inflexibility, while improving dispositional mindfulness and self-compassion in high performance athletes. This was evaluated via a SCD. The results confirmed all four research hypotheses. Mindfulness psychoeducation with the 30-day 1 Giant Mind meditation smartphone application appeared to successfully combat stress in high performance athletes, decrease psychological inflexibility as well as increase dispositional mindfulness and self-compassion from baseline to post intervention. This is the first pilot study to measure the benefits an Automated Self Transcendental meditation technique with the 1 Giant Mind smartphone application in a population of high performance athletes. The result of the current pilot study provided promising evidence that mindfulness psychoeducation and meditation can be helpful to high performance athletes experiencing high levels of stress. This chapter will provide an in depth exploration of the results of the current pilot study. Included is a detailed discussion of hypotheses testing and common trends across all four measures and ends with research limitations and suggestions for future research.

a. Hypothesis one: A Reduction in Perceived Stress

A reduction in perceived stress scores was observed from baseline to post intervention. This was observed across all three participants, with a large group level effect (SMDall = -0.93). At an individual level, the intervention was considered very effective for decreasing stress in P1 (PND = 100%) and effective for P2 (PND = 80%) and P3 (P3 = 80%). These findings are in line with research which has demonstrated that MBIs can successfully decrease perceived stress in athletes (Hargrove et al., 2013; Furrer et al., 2015; Brown et al., 2007; Gustafsson et al., 2015). There were several findings in the perceived stress measure worthy of discussion.

First, P1 and P2 presented stable baseline scores across the baseline testing period, while P3 presented a decrease in perceived stress from week one to week three of baseline

testing (see Figure 5). Due to P3s large reduction in perceived stress during baseline testing, P3 was required to take an additional two weeks of baseline testing to detect a more stable baseline pattern for post intervention comparison. A decrease in P3s perceived stress during baseline is important observation as the inclusion criteria required male participants to have a perceived stress score of 23 more for the purpose of observing whether the intervention would reduce perceived stress in stressed participants overtime. P3 qualified for the study with a perceived stress score of 23. By the time baseline scores were stabilised over the last few weeks, P3s perceived stress scores were as low as 13, compared to a score of 28 during week one and 22 during week two of baseline testing. This may have influenced within subject comparison throughout the intervention whereby the intervention may have had a greater effect had P3 maintained stable high perceived stress scores during baseline testing. One possible explanation for P3s large decrease in perceived stress during the first three weeks of baseline testing may be due to external influences outside of our control.

During baseline testing, New Zealand had just come out of COVID-19 alert level three and into alert level two restrictions. A recent study by Frank et al., (2020) reported increased diagnoses of mental disorders among athletes during the COVID-19 pandemic due to a number of stressors including lack of access to training facilities. During alert level three, P3 would not have been able to train, potentially resulting in greater levels of stress compared to alert level two where P3 was able to return to training. Further evidence supporting the relationship between COVID-19 restrictions and athletes' perceived stress has demonstrated significant increases in athletes perceived stress before and during COVID-19, with medium to large effect sizes (di Fronso et al., 2020). It is possible that changes in New Zealand COVID-19 regulations during the baseline testing period effected P3s perceived stress; fewer regulations in alert level two may explain the sudden reduction in P3's perceived stress from week two to week three of baseline testing.

When considering changes observed in P3s perceived stress during baseline testing, it is worth noting that changes in other dependent variables may have also influenced perceived stress. Studies have demonstrated a multifaceted relationship between MBI interventions and perceived stress, with a number of possible moderating variables, such as dispositional mindfulness (Shapiro et al., 2011), role of attachment style (Cordon et al.,2009) and personality type (Nyklíček & Irrmischer, 2017). Although the intervention had not yet started

during baseline, it is possible that changes in dispositional mindfulness and other psychological constructs in response to other life events such as COVID-19 restrictions (di Fronso et al., 2020), may have influenced P3's perceived stress during baseline (Shapiro et al., 2011). Baer et al. (2012) found that changes in mindfulness in response to a MBI preceded changes in perceived stress suggesting that mindfulness skills may mediate the relationship between MBI and perceived stress.

Another key finding in for perceived stress is an observed extinction burst. An extinction burst occurs when a person's reaction to a stimulus (i.e., meditation) that once produced positive reinforcements (i.e., decreased stressed) ceases to exist (i.e., no change in stress, or an increase in stress). This is followed by the initial reaction to the stimulus presenting again (i.e., decreased stress). Often a person will experience a rapid decrease in stress in response to certain interventions. After some time, stress may start to increase before it drops again (Katz & Lattal, 2020; Paredes & Morilak, 2019). This may have been the case in P1 and P2 who showed a decrease in perceived stress from baseline to mid intervention testing followed by increase from the second point of mid intervention testing to the first week of post intervention testing, before reducing again during the last week of post intervention testing (Figure 5). However, this is only one example of a possible extinction burst out of a small sample size, making the inference of an extinction burst inconclusive.

One possible explanation for the observed extinction burst may be due to meditation activity post intervention. It is possible that P2 stopped meditating post intervention and as a result, stopped benefiting from regular meditation practice which may have led to an increase in stress from mid to post intervention (Figure 5). The effects of meditation activity post intervention have been demonstrated by Carmondy and Baer (2008) who suggested that time spent engaging in home practice of formal meditation exercises was significantly related to the extent of improvement in most facets of mindfulness, as well as several measures of wellbeing including perceived stress. In further support of the importance of meditation post intervention, additional research has demonstrated structural changes in certain brain areas in regular meditators. Positive changes were found in those who regularly practised meditation when compared to nonmeditators. Structural changes in participants brain structure were related to sustained attention, self control, emotional regulation, compassion and interoceptive perception outside of meditation practice (Lazar, et al., 2005; Hernández et al.,

2016; Toneatto et al, 2009). Taken together with the current research findings, it is possible that meditation activity post intervention may have effected P2s perceived stress; less meditation activity may explain an observed burst of increased stress from mid to post intervention testing (Figure 5).

Another possible explanation for the observed improvements during the last week of post intervention following as seen in P1 and P2 may be due to improved coping mechanisms. Even if P1 and P2 had stopped meditating post intervention, mindfulness psychoeducation combined with the meditation intervention likely provided the participants with valuable coping skills and attentional resources that were potentially maintained without regular meditation practice post intervention. This is supported by the broaden and build theory of positive emotions where positive emotions developed through meditation practice (Jones et al., 2018) may enhance problem solving abilities, broaden attention, and build resources that are positively reinforced over time (Jones et al., 2019).

In combination with the broaden and build theory, the Transactional Model of Stress and Coping may also explain improvements in stress observed in P1 and P2 during the last week of post intervention testing (Figure 5). The Transactional Model of Stress suggests that a person's experience of stress is a product of the transaction between a person, including cognitive appraisal and coping mechanisms, and their environment (Chiu et al., 2016). Due to the likelihood of them gaining coping resources early on in the intervention, participants appraisal of stressful events during post intervention testing may have been appraised as a positive challenge and as something that they could manage. The result would be less perceived stress (Eatough, 2015). The development of coping skills and positive appraisal of stressful situations were likely developed through mindfulness psychoeducation in combination with meditation practice through the promotion of a nonjudgmental and accepting perspective of their inner experiences and surrounding environment, as well as greater present moment awareness. Attention to the present moment from a place of experiential acceptance is an adaptive coping resource that has been shown to help individuals perceive stressful events more objectively, and refrain from attaching personal significance to such events. The current intervention may have contributed to the acquisition of adaptive appraisals whereby participants were less likely to perceive stressful situations as a threat exceeding beyond their ability to cope (Wendling, 2012). Based on The Broaden and Build Theory and The

Transactional Model of Stress, it is possible that the development of coping skills throughout the intervention can explain the observed decrease in stress during the last few weeks of post intervention testing, independent of meditation activity. Therefore, meditation activity post intervention may not be the only factor contributing to post intervention benefits.

Another finding worthy of mention was a plateau effect observed in perceived stress during mid intervention and post intervention testing (Figure 5). P1s perceived stress scores plateaued during mid intervention testing, while P3s perceived stress scores plateaued between the second point of mid intervention and the first week of post intervention testing. One possible reason for the plateau observed in perceived stress may be due to a ceiling effect. A ceiling effect occurs when the majority of values obtained for a variable approach the upper limit of the scale used in its measurement or, as in this case, when an independent variable no longer has an effect on a dependent variable (Goedendorp & Steverink, 2017). It is important to note that while P1s perceived stress scores plateaued mid intervention, these scores were also the lowest perceived stress scores recorded for P1 during the study. It may be that P1 reached the maximum benefit for reduced perceived stress early on in the intervention, while P3 reached a near maximum benefit for reduced perceived stress towards the end of the intervention (Table 1).

The ceiling effect observed in P1 mid intervention can likened to findings in randomised pilot study using a meditation smartphone application with adults. The results showed that the rate of improvement was largest on satisfaction with life, resilience and reduced perceived stress at day 10 dropping moderately by day 30 The rate of benefit was greatest between baseline measures and at day 10 mid mindfulness intervention. Champion et al. (2018) suggested that mindfulness training resulted in a rapid reduction in stress, beyond which further reductions occurred at a much slower rate.

b. Hypothesis two: A Reduction in Psychological Inflexibility

A reduction in psychological inflexibility was observed from baseline to post intervention. This was observed across all three participants, with a large group level effect (SMDall = -0.92). The intervention was considered very effective for decreasing psychological

inflexibility for all three participants (PND = 100%). This measure also presented some findings worthy of discussion.

P3 showed a gradual continued decrease in psychological inflexibility throughout the intervention. Similar to P1s measures for perceived stress and self-compassion, her psychological inflexibility decreased from baseline to mid intervention before increasing from mid to post intervention, followed by another decrease during the last two weeks of post intervention testing for (Figure 7). P2 showed a gradual decrease in psychological inflexibility until the last week of post intervention testing when psychological inflexibility started to increase again. Wendling (2012) found that more frequent meditation activity in Buddhist meditators was associated with lower levels of psychological inflexibility and that meditation frequency was significantly related psychological flexibility; as a result, meditators were significantly lower in psychological inflexibility that nonmeditators. It is possible that less meditation activity may have accounted for an increase in psychological inflexibility observed in P1 and P3 towards the end of the intervention, and during post intervention.

Overall, psychological inflexibility decreased from baseline to post intervention for all three participants with a large group level effect (Table 2). This is in line with a great deal of research which has suggested that MBIs can successfully decrease psychological inflexibility in high performance athletes (Schwanhausser, 2009; Carrança et al., 2019; Gross et al., 2018; Levin et al., 2017). This is an important observation to make as reduced psychological inflexibility (or enhanced psychological flexibility) is more than just a mindset, it denotes a set of adaptive behavioural responses that can enhance wellbeing and performance outcomes in the most stressful situations (Glomb et al., 2011). For example, psychological flexibility is made up of key facets of mindfulness such as experiential acceptance, contact with the present moment, self as context and defusion. These facets of mindfulness allow a person to engage in committed action towards values driven behaviour. A person who is low psychological inflexibility as seen in the current findings, is more likely to maintain behaviours that keep them connected to their values and performance goals, even when faced with challenging internal or external experiences (Bond et al., 2011; Johles et al., 2020).

Interventions that successfully reduce psychological inflexibility are especially relevant to high performance athletes who are regularly exposed to the immense pressures associated

with the demands of high-performance sport (Chambers et al., 2009). As demonstrated by the Human Stress Response Curve in Figure 2, stress that exceeds optimal levels of eustress during sport is commonly known to be a key contributing factor in poor performance (Harmison, 2006; Peifer et al., 2014). The detriments of stress can be associated with a rigid attachment to, or focus on difficult internal experiences (e.g., negative thoughts) and external experiences (e.g., large crowds) (Bond et al., 2011). The Theory of Ironic Thought Processes has demonstrated how attachment to difficult thoughts through the need to control and counter them can make unwanted thoughts more intense while person becomes less focused on the task at hand and more fixated on potentially distracting internal dialogue (Binsch et al., 2009). Reinvestment Theory has demonstrated how being overly focused on the need to control implicit motor skills in high stress situation can impair motor skill performance (Masters, 1992). Both theories demonstrate the detrimental effects of psychological inflexibility, characterised by a rigid dominance of psychological reactions over chosen values and in guiding action (Bond et al., 2011).

Research has shown that athletes who are less psychologically inflexible are better able to accept difficult internal and external experiences while remaining focused on the task at hand. They are also more likely to align with their values that guide them towards accomplishing their performance goals, rather than impulsively reacting on fluctuating thoughts and emotions (Henrikson et al., 2020). This type of emotion driven behaviour is an example of experiential avoidance. Experiential avoidance and psychological inflexibility go together whereby a person high in psychological inflexibility attempts to alter the intensity or frequency of unwanted internal experiences to avoid the experience of such experiences (Roemer & Orsillo, 2002). Experiential avoidance is an example of how a person may engage in maladaptive emotion driven behaviour or short-term gratification as opposed to adaptive values driven behaviour. Emotion driven behaviour is characterised impulsive reactions based on how a person is feeling at a certain time (e.g., giving up on something because it's hard and elicits feelings of frustration). Values driven behaviour may involve allowing oneself to feel frustrated while aligning with a particular value of perseverance, where an athlete may continue to try at something even when it's easier to give up (Josefsson et al., 2019). This type of values driven behaviour is the essence of psychological flexibility and is an example of how psychologically flexible athletes are more likely to perform better when exposed to numerous stressors (Giges & Reid, 2016).

As demonstrated in the current findings, mindfulness psychoeducation and meditation can successfully decrease psychological inflexibility in high performance athletes (Figure 7). This is a benefit as low psychological inflexibility may not only help an athlete cope with difficult thoughts and feelings, but may give an athlete the coping resources to thrive and perform optimally in the face of distressing experiences which may otherwise impair performance (Gross et al., 2011; Chiu et al., 2016). This is especially important for athletes who are often faced with high stress situations which have the potential to impair performance and when recurrent, can also result in burnout (Li et al., 2019). Therefore, the enhancement of any psychological construct that is directly related to adaptive behavioural outcomes such as enhanced psychological flexibility, should be considered as an important mechanism of change when assessing the effectiveness of MBIs with high performance athletes.

c. Hypothesis three: An Increase in Dispositional Mindfulness

An increase in dispositional mindfulness scores was also observed from baseline to post intervention. This was observed across all three participants, with a large group level effect (SMDall = 2.6). These findings are in line with a large body of research that has demonstrated MBIs to be successful at increasing dispositional mindfulness in athletes (Goodman et al., 2014; Josefsson et al., 2019; Hasker, 2010; De Petrillo et al., 2009). Dispositional mindfulness is particularily helpful to high performance athletes presenting high levels of stress such as cognitive stress, which is associated with ruminating on negative thoughts (Lovallo, 2016).The five facets of dispositional mindfulness as measured by the MAAS include observing (noticing internal and external experiences), describing (labeling experiences with words), acting with awareness (attending to one's present activities and avoiding automatic pilot), nonjudging of inner experience (taking a nonevaluative stance toward internal phenomena), and nonreactivity to inner experience (allowing thoughts and feelings to come and go, without getting carried away by them) (Brown & Ryan, 2003). Through these mechanisms of change, enhanced dispositional mindfulness has been shown to reduce perceived levels of stress through promoting present moment awareness characterised by less focus negative thoughts of past or anticipated future experiences, and more focus on the task at hand (Bränström et al., 2011).

It is important to note that while athletes high in dispositional mindfulness may be more aware of the present moment and better able to redirect attention, it does not imply that an athlete who is high in dispositional mindfulness does not have negative thoughts or emotions. There are other important mechanisms of change in dispositional mindfulness that further explain how an athlete can have negative thoughts and emotions without becoming distracted or consumed by them. Birrer and Morgan (2010) introduced a model of potential psychological skills to cope with the psychological requirements for world class performance. They found that MBIs influenced the psychological functioning of elite athletes via numerous impact mechanisms. A model of potential impact mechanisms of mindfulness facets and components on psychological skills in athletes by Birrer et al. (2012) suggested that enhanced dispositional mindfulness can benefit athletes in several ways. Dispositional mindfulness improves bar attention which directly enhances attentional and cognitive skills. As such, athletes may become less distracted by thoughts and emotions and more focused on adapting to task relevant information in pursuit of attaining performance goals. According to Birrer's et al. (2012) model, dispositional mindfulness also improves self regulation. Athletes high in dispositional mindfulness become better able to cope with negative emotions. Enhanced emotion regulation is thought to serve as an adaptive coping mechanism. Another impact mechanism of dispositional mindfulness is exposure. Through a willingness to remain aware and attentive to the present moment, athletes are also encouraged to allow present moment thoughts and emotions to exist. As such, athletes become more willing to endure negative internal experiences without becoming controlled by them. In doing so, athletes learn that negative thoughts and emotions can exist without dominating their attention and acting as a distraction. Consequently, athletes may become less fearful of difficult thoughts and emotions, and more willing to confront challenging situations during training and competition which may serve as important opportunities for success and growth. Exposure to difficult internal experiences may also increase athletes pain threshold resulting in greater pain management, further developing an athletes set of coping mechanisms.

A primary mechanism of change in dispositional of mindfulness is present moment awareness. Present moment awareness is not only linked to decreased stress and negative affect (Bishop et al., 2004) but also enhanced performance, making dispositional mindfulness particularly valuable psychological construct for any athlete seeking consistent optimal performance outcomes in highly competitive environments (Josefsson et al., 2019). Research

on flow state has suggested a number of prerequisites to experiencing flow, including undivided attention to the task at hand (Csikszentmihalyi, 1997). One study showed a positive relationship between dispositional mindfulness and flow in elite level athletes. Cathcart et al. (2014) administered the MAAS and Dispositional Flow Scale to 92 elite level athletes and found a significant correlation between mindfulness and flow. Other studies have found a direct link between flow and enhanced performance following mindfulness training (Schwanhausser, 2009; Bernier et al., 2009). Therefore, interventions aimed to enhanced dispositional mindfulness may be particularly helpful to high performance athletes performance outcomes.

In addition to large post intervention improvements in dispositional mindfulness, there were several other findings in the dispositional mindfulness measure worthy of mention. Unlike participants measures for stress, psychological inflexibility and self-compassion, participants level of dispositional mindfulness continued to gradually benefit from baseline through to mid and post intervention measures. As demonstrated in Figure 9, P3s dispositional mindfulness scores continued to gradually increase from mid intervention right through until the last week of post intervention testing. P1 showed an improvement in scores from baseline to mid intervention, but no change in scores from mid intervention to the first week of post intervention, followed by an increase in mindfulness during the last two weeks of post intervention testing. P2 showed an improvement in mindfulness from baseline to mid intervention and from mid to post intervention, with no change in scores from the first week to the second week of post intervention testing. This was followed by an increase in mindfulness from the second week to the third and last week of post intervention testing. Overall, and unlike other measures in the current pilot study, mindfulness scores did not decrease from mid to post intervention for any of the participants.

There are a number of possible explanations for the observed consistent and large improvements in dispositional mindfulness (Table 3). MBIs that include meditation practice have shown changes in grey matter concentration in brain regions responsible for learning and memory processes, emotion regulation, self-referential processing, perspective taking. Structural changes were related to greater mindfulness scores over time, specifically in sub scales related to acting with awareness, nonjudging, describing and nonreactivity (Hölzel et al., 2011). Evidence has suggesting meditation interventions work at a neurological,

structural and functional level (Hölzel et al., 2011; Lazar et al., 2005; Hernández et al., 2016; Taren et al., 2013) further demonstrates how mindfulness is an adaptive skill that can be learned and sustained with ongoing meditation practice (Carmody & Baer, 2007; Lykins & Baer, 2009; Hölzel et al., 2011). Lazar et al. (2005) demonstrated increased cortical thickness in the insula in long term meditators. Increased thickness of the insula correlated with increased emotional awareness. Awareness of ongoing events and internal experiences is key measure of the MAAS (Brown & Ryan, 2003). Increased thickness in brain areas are directly related to neuroplasticity where the brain creates neural networks in certain areas in response to a person's experience, in this case, the practice of meditation. The creation of new neural networks is associated with enhanced functioning within that area. Structural and functional changes in the brain related to enhanced EEG recorded alpha coherences and brain integration have also been demonstrated with Automated Self Transcendental techniques, which is similar to the 1 Giant Mind technique used in this pilot study (Travis et al. 2009; Hurung et al., 2009).

One study found significant structural and functional changes within eight weeks of meditation practice. In randomised control trial, Kilpatrick et al. (2011) found changes in functional connectivity in brain areas related to attentional and self-referential processes in participants after completing eight weeks of mindfulness meditation training as part of a Mindfulness Based Stress Reduction intervention. These findings suggested that eight weeks of mindfulness meditation training can alter the function of brain connectivity in ways that are consistent with enhanced awareness, attentional focus and sensory processing. Other studies have demonstrated that continued mindfulness practice is associated with decreased activity in the cingulate posterior cortex which is correlated with less distraction by thoughts (Manuello et al., 2016). The MAAS measures a person's ability to regulate attention towards task relevant stimuli, which may become more possible without the distraction of thoughts (Brown & Ryan, 2003). Mindfulness has been shown to increase the connection between the amygdala and the prefrontal cortex. This connection is thought to regulate the emotion of anxiety (Barnby et al., 2015). Because athletes are often exposed to high stress environments such as that of competition, enhanced connectivity between the amygdala and prefrontal cortex may help athletes focus on the task at hand during stressful experiences rather than becoming consumed by feelings of anxiety (Manuello et al., 2016). It is therefore possible

that the current intervention elicited structural and functional neurological changes which may explain the large effect size of the intervention on participants dispositional mindfulness.

A ceiling effect may also explain a plateau observed in dispositional mindfulness scores (Goedendorp & Steverink, 2017). Mindfulness scores plateaued for P1 during week seven of mid intervention testing and week eight of post intervention testing. For P2 and P3, a plateau effect was observed during post intervention testing; P2's dispositional mindfulness scores plateaued during first two weeks of post intervention testing, and P3's dispositional mindfulness scores plateaued during the last two weeks of baseline testing (Figure 4). Jones et al. (2019) found a similar plateau effect in their in a randomised control trial. The results showed that benefits of a one-week long meditation intervention began to level off between post-test (day eight) and follow up (day twenty-two) testing. Although effect sizes were small for this plateau pattern, it is possible that those who spent the most time meditating reached a ceiling effect, and participants had reached their maximum potential when it came to coping flexibility). It is possible that the plateau represented the current participants near maximum benefit from mindfulness towards the end of the intervention. However, follow up testing would be needed to assess whether dispositional mindfulness were maintained.

d. Hypothesis four: An increase in Self-Compassion

An increase in self- compassion was observed from baseline to post intervention. This was observed across all three participants, with a large group level effect (SMDall = 0.92). The intervention was considered very effective for increasing self-compassion for P2 (PND = 100%), moderately effective for P3 (PND = 60%) and ineffective for P1 (PND = 20%). This measure also presented several other key findings. First, P1 showed a large decrease in self-compassion from week one to week two of baseline testing (see Figure 11). Although self-compassion for P1 improved from baseline to post intervention testing, the intervention was considered small and ineffective (SMD = 0.41, PND = 20%). This was the only small and ineffective result in the present pilot study. There are a number of possible explanations for this.

One possible explanation for P1s drop in self-compassion during baseline testing may be due to external influences outside of our knowledge. Ingstrup et al. (2017) showed three

main themes that contributed to the development of self-compassion in 114 female university athletes; these included: the role of parents (seeking and receiving help from parents, parents teaching self-kindness, parents putting experiences in perspective), and gaining self-awareness and learning from others (peers, siblings, coaches, sports psychologists). Their research suggested that an athlete's level of self-compassion is largely learned and elicited through greater levels of self-awareness. Frentz et al. (2020) further indicated how others can influence an athlete's experience of self-compassion. An interpretive description guided study explored how high-performance athletes shifted from self-critical to self-compassionate approaches to manage sport related challenges. Results found that social support from teammates and other athletes fostered more self-compassion, while conflict, negativity and opposing individual and team goals stood in the way of the transition from self-criticism to self-compassion. Athletes also reported the significance of a strong coach athlete relationship, while highlighting how a negative and excessively critical coach can lead to a downward spiral of self-criticism. Taken together, external influences that were outside of the studies investigation such as such as learned self-awareness and self-compassion (Ingstrup et al., 2020), as well as the participants' relationship with team mates and coaches (Frentz et al., 2020) may explain the sudden drop in self-compassion scores for P1 from week one to week two of baseline testing, and may also explain the general fluctuations in P1s self-compassion scores throughout the intervention (Figure 11).

Another possible explanation for the small effect size and drop in self-compassion during baseline testing observed in P1 may be due gender orientation. P1 was the only female participant in the study. A meta-analysis by Yarnell et al. (2019) examined the joint associations of self-identified gender and gender role orientation with self-compassion in undergraduate (N = 504) and community adult (N=968) samples. The results suggested that, in general, women have slightly lower levels of self-compassion than men. Interestingly, the results from this study discovered that it is not so much gender that shapes self-compassion tendencies, but gender orientation. For example, men can express feminine norms while women can express more masculine norms. While some people have more of a balance between masculine and feminine orientations, other people can be more or less masculine or feminine, independent of their gender. The meta-analysis found that women and men with a more masculine gender orientation reported higher levels of self-compassion than women and men with more a feminine gender orientation. It is possible P1 had more of a feminine gender

orientation than the male participants. This may also explain the small improvements in self-compassion in response to the intervention, as well as lower levels of self-compassion during baseline testing compared to other research participants: males who may be more masculine orientated (Figure 11). Based on the above research and current findings, we cannot rule out the influence of these external factors across all participants. It is possible that influence from others and gender orientation may also explain the moderate effect size demonstrated by P3 (PND = 60%).

Similar to perceived stress and psychological inflexibility, self-compassion also improved from baseline to mid intervention, decreased from mid to post intervention testing, and then increased again during the last week of post intervention testing for P1 and P2 (Figure 11). As it was for perceived stress and psychological inflexibility, it is possible that less frequent meditation activity towards the end of the intervention and into post intervention may have accounted for a decrease in self-compassion. Other dependent variables such has perceived stress may have also influence self-compassion levels during and throughout the intervention (Stutts et al., 2018). A longitudinal analysis of the relationship between self-compassion and the psychological effects of perceived stress in healthy adults found a negative relationship between perceived stress and self-compassion (Stutts et al., 2018). For P1 perceived stress increased from mid to post intervention (Figure 5); at the same time, P1s self-compassion decreased (Figure 11). Similarly, a decrease in self -compassion during the last week of post intervention testing occurred with an increase in perceived stress for P3. It is therefore worth considering whether changes in other dependent variables, such as perceived stress had affected P1s fluctuating levels of self-compassion throughout the intervention.

e. Mid Intervention Benefits

Benefits of the current pilot study intervention were observed as early as two weeks into the meditation intervention across all four measures, as demonstrated in Figures 5, 7, 9 and 11. In line with the current pilot study findings, Cavanagh et al. (2013) also demonstrated benefits of meditation as early as two weeks into a MBI. Based on the current findings and in line with additional evidence which has demonstrated the benefits of meditation interventions in one (Jones et al., 2019) to two weeks (Cavanagh et al., 2013), it worth questioning the

optimal length of meditation interventions, and whether or not the current intervention needed to run for four weeks. There have been mixed findings.

Research using fMRI brain imaging has demonstrated significant differences in brain structure and function of long term meditators compared to nonmeditators (Lazar et al., 2005; Hernández et al., 2016). These neuroimaging studies provide evidence that long term meditation practice is required for sustained benefits. However, other research has shown that long term meditation may not be necessary to obtain meditation benefits. Gotink et al. (2016) conducted a systematic review of evidence for the effects of mindfulness meditation techniques on brain structure and function using fMRI. Their results indicated the changes in brain structure and function in participants who had been meditating for only eight weeks during a mindfulness based stress reduction intervention were similar in those who had been meditating regularly for several years. Changes were found in the amygdala which was associated with improved emotional regulation, as well as in other brain areas, including the prefrontal cortex which was associated with stress reducing benefits. Gotink's et al. (2016) research demonstrated that the benefits of meditation can be observed at a structural and functional level within eight weeks.

It is important to note that Gotink et al. (2016) did not consider sustained benefits of participants in the eight week mindfulness intervention. This is an important observation to make. While the current pilot study findings suggested that participants obtained benefits within two weeks to four weeks, evidence has suggested that to sustain benefits, long term meditation practice is key (Lazar et al., 2005; Hernández et al., 2016; Carmody & Baer, 2007; Lykins & Baer, 2009). Based on research which has suggested that regular meditation practice is associated with sustained benefits (Lykins & Baer, 2009; Carmody & Baer, 2007), it is likely that benefits of a MBI using psychoeducation and meditation can be observed within two weeks. However, to sustain such benefits, participants may need to continue to practice meditation post intervention.

Another likely explanation for the observed early intervention benefits across all four measures can be explained by the benefits of psychoeducation. Psychoeducation was given one day prior to starting the meditation intervention with the aim of giving participants a clear understanding of processes and the relevant benefits related to mindfulness, while

creating realistic expectations for participants going into meditation. Unrealistic expectations of meditation can often strip meditation of its real potential (Baer et al., 2019). Participants who go into meditation intending to quiet the mind may find that meditations are characterised by lots of thinking, heightened awareness of emotions and associated internal discomfort, all of which can be very challenging and potentially distressing (Gross et al., 2018). To account for this, popular MBIs, as well as the current research intervention, use psychoeducation to inform meditators that meditation is less about quietening the mind and more about observing the mind from a place of nonjudgmental awareness and experiential acceptance. As a result, participants gain a clear understanding of meditation, and may be less put off by challenging 'busy' meditations (Gardner, 2009; Gross et al., 2018). This is emphasised in Gardner and Moore's (2007) Mindfulness Acceptance Commitment Therapy as part of their psychoeducation module, which emphasises that positive thinking and relaxation is a secondary benefit of mindfulness and meditation rather than the primary goal.

In line with Gardner and Moore's (2007) psychoeducation module, the current psychoeducation session reinforced that the primary goal of mindfulness and meditation is not to create a sense of calm, to quiet the mind or control thoughts, but to allow thoughts to coexist without the need to eliminate or control them. This was achieved in the current psychoeducation session by defining and explaining key mechanisms mindfulness including of nonjudgemental awareness, experiential acceptance and defusion to all internal experiences (Gardner, 2009) (see Appendix K for the psychoeducation transcript). Therefore, psychoeducation likely promoted development of personal resources for more adaptive coping and positive stress appraisal in response to potential stressors early on in the intervention (Jones et al., 2018; Eatough, 2015). This is demonstrated through reduced perceived stress scores across all three participants within the first two weeks of the intervention.

It is possible that without mindfulness psychoeducation, participants may have gone into the meditation component of the intervention with unrealistic expectations which may have had a negative effect on their experience of meditation and engagement with the app (Baer et al., 2019), and the observed early benefits may not have been as prominent. In this case, it was not psychoeducation or meditation that accounted for the observed benefits, but rather the combination of both. Knowledge acquired through psychoeducation becomes

experiential through formal meditation practice. For example, experiential acceptance, present moment awareness and defusion are key processes in mindfulness. Together, these processes serve as a willingness observe and to experience all internal events without buying into thoughts as absolute truths and succumbing to emotion-driven reactive behaviour (Henrikson et al., 2020). Through psychoeducation participants learn these concepts, and through meditation participants are able to experience them. It is experience that elicits neuroplasticity in the brain where the brain will change structurally and functionally in response to its experience (Kilpatrick et al., 2011).

It is important to mention the role psychoeducation plays in promoting participant adherence to meditation practice. The potential for a high dropout rate was a major concern for the current study due to the required time commitment of 10 to 20 minutes of meditation practice per day as well as regular testing, especially during baseline and post intervention testing. It was anticipated that participants may not have the time or motivation to complete the research intervention and, meditate regularly throughout the initial proposed 42 day period. Research has shown MBIs to be associated with high dropout rates due to time constraints (Hendricks et al., 2019), and studies have highlighted the importance of psychoeducation in MBIs for the purpose of enhancing participant adherence and engagement with at home meditation practice (Gross et al., 2018; Hendricks et al., 2019; Carrança et al., 2019).

It is worth questioning whether benefits observed within two weeks of the intervention would have existed without psychoeducation, or if a lack of psychoeducation may have caused participants to either drop out or fail to adhere to regular meditation practice. Due to the nature of the current pilot study, the effects of mindfulness psychoeducation or meditation in isolation cannot be determined. It can only be suggested that the benefits observed in the current pilot study were due to a combination of both mindfulness psychoeducation and meditation.

2. Meditation Activity

To further understand the implications of meditation activity mid intervention, a brief follow up post intervention survey assessed participants meditation activity during the intervention (Appendix J). P1 reported meditating at times, as little as twice a week. P2 reported meditating three to five times a week, while P3 reported meditating the most

frequently with five to seven meditations per week during the intervention. Although P3 meditated more often, P3 did not show any obvious greater benefits when compared to P1 (excluding the self-compassion measure) and P2. This may suggest that more meditation activity is not always better. Based on the current findings it would seem that P1 still benefited from as little as two meditations a week. However, P1 was the only participant to show no effect in the self-compassion measure (PND = 20%). It is possible that two meditations per week are the bare minimum, and that more meditations per week will likely benefit participants more, especially on measures for self-compassion.

Across all four measures, P2 consistently demonstrated medium to large effect sizes . In the post intervention follow up survey, P2 reported meditating three to five times a week. P3 reported meditating the most out of all three participants with five to seven meditations per week yet in general, P3 did not show any greater improvements in response to the intervention compared to the other participants. In fact, P3s mean perceived stress and self-compassion scores sat closer to the Brinley plot line of no change small suggesting baseline to post intervention changes.

There are a number of possible explanations for the above findings. First, it is likely that P3 failed to show a large change in perceived stress because P3s stress reduced by a great deal during baseline, making further changes in perceived stress less likely. Research has also suggested an inverse relationship between perceived stress and self-compassion (Stutts et al., 2018). It is possible that low levels of stress resulted in greater self-compassion early on in the study. However, due to the nature of the current SCD, the relationship between dependent variables cannot be inferred; as such, it would be helpful to investigate these constructs with a larger sample in a randomised control trial (Fritz & MacKinnon, 2007). Based on the findings, it is likely that three to seven meditations per week may be more beneficial than two meditations per week. This is in line with evidence that has suggested that the benefits of meditation can be sustained by those who meditate at least three times a week (Perich et al., 2013; Schenström et al., 2006).

However, optimal meditation activity cannot be confirmed in the current pilot study. There are mixed findings as to how often a person needs to meditate to obtain and sustain benefits. One way to interpret the current findings and in line with the above research is to

consider whether participants may only need to meditate three times a week to experience the benefits of meditation. The benefits of meditating at least twice a week was demonstrated by Lykins and Baer (2009) who compared self reports of dispositional mindfulness and other constructs related to mindfulness from long term meditators who had been meditating at least twice a week for the last three years, to self reports from demographically similar nonmeditators. Mediation analysis showed that regular meditation practice, which included meditating two to seven times per week over one or more years increased mindfulness in everyday life when compared to demographically similar non meditators. Increased mindfulness was also related to decreased rumination, decreased fear of emotion and increased behavioural regulation in long term meditators compared to nonmeditators.

In contrast, Allen et al., (2012) found that the amount of meditation practiced during an eight week mindfulness intervention predicted an increase in prefrontal cortex activation during mindful emotion processes. The study found that adaptive changes in brain structure and function were largely dependent on practice adherence where participants who meditated for 20 minutes daily showed the greatest benefits. Taken together with the current findings, it is possible that meditating as little as two times per week long term may be enough to sustain benefits. But in order to obtain the greatest benefits early on, Allen's et al (2012) study suggests that practice adherence is key.

The current study cannot draw any conclusions regarding sustained benefits. Yet the importance of frequent home meditation practice outside of traditional MBI is emphasised as one of the primary mechanisms by which participants become more aware of and able to relate differently to potentially distressing thoughts in a more adaptive manner (Segal et al., 2013). However, a lack of meditation activity data is a common limitation across many MBI studies. Vettese et al. (2009) found that of over 90 empirical MBI studies reviewed, only 24 examined the association between the amount of home practice and subsequent outcome. Only 13 found partial evidence of a positive relationship between regularity of home practice and positive outcomes. As such, little is known about the relationship between home practice and outcomes.

Despite limited research on the relationship between meditation activity and sustained benefits, it is still worth questioning how meditation activity may explain the current research

findings. Studies have shown mixed findings. Lacaille et al. (2017) suggested that adherence to regular meditation practice was important for eliciting therapeutic change and obtaining immediate short-term benefits of meditation day-to-day. In their study, meditation practice was assessed using a daily dairy in 117 participants who underwent a Mindfulness Based Stress reduction intervention. The results showed a positive relationship between meditation practice and psychological benefits where participants were more likely to respond to daily life events with greater mindfulness. In addition to this, longer and more regular meditation practices were independently associated with increases in mindful responding, which were associated with better psychological outcomes including reduced perceived stress.

To assess long term benefits of MBIs, Bowen and Kruz (2014) assessed the effects of between session mindfulness practice and therapeutic alliance on levels of mindfulness at two and four months after an eight week MBI. The results from this study found that between-session practice over the course of the eight week MBI was predictive of mindfulness early post intervention. Although significant increases in mindfulness were maintained at four month follow up, the results suggested that this was not due to at home meditation practice, suggesting that other factors may predict long term benefits in mindfulness. In line with the Broaden and Build Theory, it is possible that enhanced therapeutic alliance and mindfulness psychoeducation throughout the intervention, combined with formal between session meditation practice during the intervention gave participants personal resources to help them be more mindful day to day without needing to meditate regularly to access these learned skills (Jones et al., 2019) – this further highlights the role of psychoeducation in sustained benefits in MBIs.

It is important to note that Bowen and Kruz (2014) did not measure changes in measures of mental health outcomes including perceived stress. It is possible that regular meditation practice post intervention is more important when it comes to coping with distressing events and internal experiences. This was demonstrated by Gamaiunova et al. (2019) who found that long-term meditators who were exposed to a social-evaluative threat had faster cortisol recovery from stress, less shame and higher self-esteem after the exposure to a threatening stressor. Further, long-term meditators scored higher on adaptive cognitive emotion regulation mechanisms including acceptance and positive reappraisal, and lower on maladaptive mechanisms such as catastrophising. It was found that faster recovery from

stress was due to regular long term meditation practice; this was regulated by acceptance (rather than avoidance) as an emotional coping strategy. Singh et al. (2012) further demonstrated the importance of regular meditation activity for sustained benefits in a sample of university students (N = 34). It was found that meditation practice reduced participants psychological stress and improved cognitive ability during a computer game. Importantly, these effects were enhanced in those who practice meditation more regularly over a one month period. It is therefore possible that post intervention meditation activity affected the current results whereby less meditation towards the end of the intervention post intervention may explain a explain a slight decrease in benefits.

Based on reports of meditation frequency during the intervention and in line with the discussed research findings, it can be inferred that two meditations per week are the bare miminum to obtain benefits in stress, mindfulness, psychological flexibility and self-compassion and that three to seven times a week may be more beneficial. It is important to make note of the difference between obtaining and sustaining benefits related to meditation. Any worthy MBI should aim to create long lasting change. As such, it is important to realise that while a person may benefit from meditation within eight weeks (Perich et al., 2013; Gotink et al., 2016) or even one week (Jones et al., 2019) of meditating, or as the current findings suggest, within two to four weeks of meditating, if benefits are to be sustained, a person will need to meditate regularly (Toneatto et al., 2009; Lykins & Baer, 2009). The current pilot study did not measure participants meditation activity post intervention or conduct follow up tests. Therefore, sustained benefits cannot be assessed from this study.

3. Psychoeducation

In the post intervention follow up survey, all participants reported finding the psychoeducation video very helpful, while P3 reported finding "the psychoeducation more useful and informative than the meditation application". Participants reports of psychoeducation as being helpful is in line with other research that highlighted the beneficial role of psychoeducation in MBI (Baer 2003; Carmody & Baer, 2007; Josefsson et al., 2019; Hendricks et al., 2019; Scott-Hamilton, Schutte, & Brown, 2016). Specific to athlete populations, Baltzell et al., (2014) investigated the effects of a MBI with elite soccer players. In post-intervention interviews, participants voiced a need for more education around

mindfulness and meditation, and how it related to their sporting performance preceding the mindfulness intervention. Athletes suggested that some form of psychoeducation around their meditation practice would help them to better understand how meditation related to their sport, to avoid confusion and to increase their engagement with between session meditations.

Another study with a group of cyclists found that athletes became more open to meditation after the facilitator, through psychoeducation, helped make the connection between meditation techniques and the applicability to their sport (Scott-Hamilton et al., 2016). In comparison, a study with Professional Australian Rules Football players assigned participants to two different meditation apps for four weeks without any formal psychoeducation. Post intervention results indicated that the meditation intervention was unsuccessful (Rist & Pearce, 2017). It is possible that a lack of psychoeducation may explain why the athletes in their study did not engage with or benefit from the meditation intervention. In line with the current participants' reports of psychoeducation as being helpful, and in one case more helpful than the meditation app, this research project further explain how psychoeducation in current pilot study was of great value. As such, the influence of mindfulness psychoeducation preceding meditation practice should not be undermined. It may also be necessary to consider athletes motivation for participating in a MBI and practicing meditation.

Other studies have surfaced suggesting that participant's level of belief in, or preference for, an intervention can act as confounding variable affecting the relationship between psychological interventions and outcomes. This may include perceived credibility and how likely the participant believes the intervention is to work. Perceived belief in the credibility and benefits of a MBIs may influence participants' motivation for engaging with the intervention and with at home meditation practice. Although no studies have shown a link between perceived belief in MBIs and associated outcomes, other studies have shown that a participant's belief in or preference for treatment for depression can have a significant predictive impact on the outcome. For example, a treatment trial for people suffering from depression found that treatment preferences for psychotherapy or pharmacotherapy influenced therapeutic outcomes (Iacoviella et al., 2007). Therapeutic alliance is a known predictor for outcomes in psychotherapy (Flükiger et al., 2012). For the current study, it is possible that psychoeducation enhanced belief of participants in the credibility and benefits of

the intervention, which may have increased their adherence to engage with the app and benefit from the intervention early on.

4. Research Limitations

The current pilot study provided important information on the effects of mindfulness psychoeducation and the 1 Giant Mind meditation smart phone application on decreasing stress and psychological inflexibility, while enhancing mindfulness and self-compassion in high performance athletes presenting high stress. However, there are some limiting factors that must be addressed as they were crucial to the development of this research project.

Many MBIs such as Mindfulness Acceptance Commitment Therapy for human performance recommend six to eight week long interventions (Josefsson et al., 2019; Gardner & Moore, 2006) with research supporting the effectiveness of six to eight week long MBIs for athlete populations (Hargrove et al., 2013; Jackson et al., 1996; Furrer et al., 2015; Brown et al., 2007; Gustafsson et al., 2015; Gross et al., 2018; Carrança et al., 2019; Levin et al., 2017; Schwanhausser, 2009; Birer et al., 2012; Jones et al., 2020; Bernier et al., 2009 & Dehghani et al., 2018). It was for this reason that we originally choose to run a six week MBI. During the psychoeducation session and on the participant information sheet, participants were instructed to practice meditation daily for forty two days (twelve days of learning, followed by a thirty day challenge). Unfortunately, the primary researcher mistook day thirty of the intervention as the end of the thirty day challenge. As such, the intervention period was reduced by twelve days. This mistake may have presented some issues worth noting.

There were two points of mid intervention testing. One on day fourteen and one on day twenty eight of the intervention. The second measure of mid intervention testing on day twenty eight would have been considered mid intervention had the intervention continued for forty two days. However in this case, the second phase of mid intervention testing was taken two days prior to the end of the intervention, and five days before post intervention data was gathered. Consequently, mid intervention testing on day twenty eight was taken too closely to the end of the intervention and was not representative of mid intervention.

Reducing the intervention by twelve days meant participants had fewer consecutive days to practice and benefit from meditation using the smart phone application. Studies have demonstrated a significant correlation between a greater number of days meditated throughout an eight week Mindfulness Integrated Cognitive Behavioural Therapy trial (Perich et al., 2013; Schenström et al., 2006). These studies have demonstrated the importance of regular meditation activity throughout an eight week mindfulness based intervention in both clinical (Perich et al., 2013) and healthy populations (Schenström et al, 2006). Based on these findings and given that participants stopped or reduced their meditation practice post intervention, the shortened intervention period may have resulted in fewer benefits compared to a longer intervention period.

While we believe that the shorter intervention period may have been limiting, it is also important to account for research which has suggested that shorter interventions can also be effective. A meta-analysis of nineteen MBI studies found that a brief four week mindfulness intervention developed for organisational settings were just as effective as the standard eight week traditional mindfulness based interventions developed for clinical settings (Virgilli, 2013). Cavanagh et al. (2013) demonstrated the effectiveness of a brief two week online MBI with a population of clinical and nonclinical students that included mindfulness psychoeducation and mindfulness meditation practice at least once a week. The results indicated improved mindfulness skills, perceived stress and anxiety/depression scores compared to a waitlist control group, suggesting a two-week long intervention may be effective for both clinical and nonclinical populations. However, it is unknown whether these benefits were maintained long term. it is likely that in order to maintain benefits developed through MBIs, participants need to keep up with regular mindfulness practice over time. Based on the above findings and in line with the current research findings, it is possible that MBI intervention periods may not need to be six weeks in length. Four week (Virgilli, 2013) or even two week (Cavanagh et al., 2013) long MBIs may be just as effective in nonclinical populations (Virgilli, 2013). This is further demonstrated in the current findings which demonstrates benefits across all four measures two weeks into the intervention. Therefore, the reduction in the current pilot study's intervention period may be less of a concern, while the proximity of the mid intervention assessment being so close to the end of the intervention may be more limiting.

The close proximity of the second point of mid intervention (day 28) and the first point of post intervention testing (day 35) meant that the second point of mid intervention testing was very similar to post intervention testing. As a result, it is difficult to get a real representation of mid intervention benefits. Based on the current findings, day 14 of mid intervention testing provides the most accurate representation of mid intervention. However, only having one data point during the intervention phase goes against SCD research guidelines (Gallo et al., 2013).

There were a number of extraneous variables that we did not control for. Participants may have experienced life events that positively impacted on their perceived stress and other measures; they may have received additional support elsewhere and situation changes in training and performance may have occurred in response to COVID regulations being lifted or other influenced outside of our control. Because no information was collected for the influence of life events outside of the study, it is difficult to infer that the observed changes were exclusively related to the intervention. Unfortunately, due to time constraints at the times of data collection, no personal information regarding life changes was collected.

Another notable limitation is a lack of data on participants' meditation activity post intervention. When it comes to understanding the potential influence of meditation activity post intervention, it should be noted that in follow up surveys, all participants in the present study reported that they intended to continue to practice meditation in the future. Meditation activity post intervention was not recorded for a number of reasons. Research has indicated time commitment as one of the main contributing factors for poor engagement and high dropout rates in MBIs with athletes (Rist & Pearce, 2017). It was for this reason that we limited the number of times participants were required to fill out surveys. As a result, we excluded assessing the meditation activity post intervention. It is therefore unknown whether or not participants were still meditating during the post intervention testing period and if so, how often. Toneatto et al., (2009) also highlighted this to be a key limitation, suggesting that that the majority of mindfulness based studies fail to adequately measure the effect of 'at home' meditation practice post intervention, and that this has implications when assessing the long term benefits of meditation interventions.

5. Recommendations for Future Research

Future research may benefit from comparing different intervention lengths. Benefits of the current intervention where observed as early as fourteen days into the intervention, suggesting that a four week intervention may not be necessary. The current findings taken together mixed research on optimal intervention lengths (Jones et al., 2019; Gotink et al., 2016; Virgilli, 2013; Cavanagh et al., 2013) with no conclusive outcomes relating to sustaining benefits long term, future research may benefit from comparing different intervention lengths.

It is evident that meditation activity post intervention plays a role in the sustained benefits of mindfulness and meditation interventions (Lykins & Baer, 2009; Carmody & Baer, 2007). A clearer understanding of meditation activity post intervention may have helped us to better understand the observed changes from mid to post intervention testing where some participant's perceived stress (Figure 1) and psychological inflexibility (Figure 3) measures started to increase before decreasing again, while self-compassion (Figure 7) scores started to decrease mid to post intervention, before increasing again. It has been suggested that meditation activity post intervention may influence observed benefits post intervention (Toneatto et al., 2009). Therefore, future research may benefit from collecting data of meditation activity post intervention.

Future research may also benefit from obtaining follow up data at three months or more to assess the relationship between meditation activity post intervention and sustained benefits. Future research may also benefit from more regular testing throughout the intervention to look for points throughout the mid intervention period where benefits were greatest. This may give researchers a more clear understanding of an optimal intervention length and a better understanding of any potential ceiling effects that may occur. When doing so, it is still important to consider the risk of high dropout rates and lack of engagement that may coincide additional demands related time commitment from athletes (Rist & Pearce, 2017), and to mitigate this as much as possible.

Future research might benefit from replicating this research with a larger population of 20 to 30 participants in a randomised control trial with t test hypotheses testing (Cohen, 2007). This would allow increased generalisability and would demonstrate whether it is possible to replicate the above results. Further, evidence has suggested a multi-faceted

relationship between MBIs and perceived stress, with a number of possible moderating variables such as dispositional mindfulness (Shapiro et al., 2011). Future research may benefit from conducting moderation analysis to explore how specific psychological constructs, such as other dependent variables may moderate the relationship between mindfulness based interventions and dependent variables. Accounting for external influences and moderating variables such as gender orientation (Yarnell et al., 2019), may be especially helpful when measuring self-compassion in female and male athletes.

Based on the current findings, the benefits of the current intervention can be attributed to a combination of mindfulness psychoeducation and meditation. Research has suggested that psychoeducation is helpful when it comes to giving athletes an understanding of the key terms and definitations attributed to mindfulness with personally relevant benefits for greater MBI adherence (Gardner & Moore, 2007). Future research may benefit from conducting a randomised control trial assessing the effects of a mindfulness psychoeducation and meditation condition, a psychoeducation condition, and a meditation condition to gain a better understanding of the effects of psychoeducation and to see if meditation alone would have similar benefits.

Studies have suggested that meditation shows the greatest benefits in participants who present greater levels of anxiety (Orme-Johnson & Barnes, 2014; Schreiner & Malcom, 2011) and stress (Schreiner & Malcom, 2011). It was for this reason that inclusion to participants in the study required participants to obtain a high PSS-10 score, indicating high levels of stress. There has been a great deal of research that has showed the success of MBIs with healthy populations including high performance athletes who may not present high levels of stress. As such, future research may consider investigating the effects of mindfulness psychoeducation and meditation with high performance athletes who are not stressed. However, if stress levels are already low, changes in stress are likely to be small. As such, measuring performance outcomes rather than stress may be more relevant to athletes who are not considered highly stressed or anxious.

Chapter Six Conclusion

MBIs similar to the current pilot study intervention are helpful to athletes because they teach athletes that negative internal and external experiences are often inevitable, especially in high performance sport. MBIs promote a new way of relating to difficult thoughts and emotions which has been shown to be more beneficial than traditional PST, which emphasises the importance of having an optimal mindset for optimal performance (Hasker, 2010; Gross et al., 2018). Mindfulness gives athletes the skills to allow for difficult internal and external experiences to exist without the need to expend their mental effort into trying to control and eliminate unwanted experiences. Mindful athletes develop the ability to have difficult internal experiences without those experiences consuming an athletes attention (Gardner, 2009; Baltzell et al., 2014). In doing so, difficult internal experiences are less likely to become a distraction and contribute to high levels of stress, which can be detrimental to an athletes mental health (De Francisco et al., 2016; Spiotta et al., 2015) and performance ability (Bali, 2015). MBIs teach athletes to focus on the task at hand in the face of distressing experiences. This allows athletes to align with their values and performance goals which promotes greater psychological flexibility in response to the numerous challenges that coincide a high performance life (Glomb et al., 2011). Based on the current findings and a great deal of research which has demonstrated the success of MBIs with athletes, mindfulness should be considered a valuable skill for any high performance athlete, especially those at risk of experiencing stress.

One way to practice mindfulness is through formal meditation practice. Most of the research using meditation applications have been conducted using Task Focused Meditation techniques (Wen et al., 2017; Bostock et al., 2019; Huberty et al., 2019; Flett et al., 2019) which require a great deal of mental effort (Lutz et al., 2009; Lumma et al., 2015) and is often perceived as quite challenging, especially for novice meditators (Ribeiro et al., 2018). This is the first study to assess the benefits of an effortless, Automated Self-Transcendental meditation technique using the 1 Giant Mind smartphone application in combination with mindfulness psychoeducation with high performance athletes. The combined benefits of mindfulness psychoeducation and meditation suggest that psychoeducation likely plays an important role in the benefits associated with meditation by giving athletes relevant knowledge required to experience and optimise the benefits of formal meditation practice (Henrikson et al., 2020). The 1 Giant Mind smartphone application was chosen for this study as it teaches a self

sustaining technique that can be practiced anywhere at any time with or without a smartphone. Research has suggested that MBIs using smartphone applications may be particularly useful to populations with busy schedules, benefiting those who may struggle to find the time or motivation to attend lengthy, costly and in person interventions (Wilson et al., 2017; Burton et al., 2016). As such, the use of the 1 Giant Mind smartphone application was considered most applicable to high performance athletes who may be time poor.

It is important that any worthwhile intervention with high performance athletes aims successfully sustain benefits long term. Therefore, a deeper understanding of the benefits of meditation activity post intervention is necessary to investigate if mindfulness psychoeducation and smart phone meditation interventions are going to be used to help stressed athletes long term. While the current results are promising, it is important to note that this is a small scale preliminary study. Future research may benefit from conducting a randomised control trial with larger sample size to ensure external validity and generalisability (Cohen 2017; Burns, 2012). Future research may also benefits comparing the difference between meditation with and without psychoeducation in order to gain a deeper understanding of the benefits of psychoeducation when using meditation.

The current pilot study findings show promise for the use the MBIs with high performance athletes. It is well known that athletes are particularly vulnerable to the detrimental effects of stress where high levels of stress do not only increase an athletes risk of anxiety, depression (De Francisco et al., 2016) and burnout (Spiotta et al., 2018), but can also impair their ability to perform (Bali, 2015). This is of a particular concern during the current COVID climate where athletes are even more likely to experience stress (di Fronso et al., 2020) due to the uncertainty that goes hand in hand with a constantly changing schedule and new found pressures that coincide a global economic crisis (Mehrsafar et al., 2020; Frank et al., 2020). Furthermore, an athlete's psychology has drastic effects on his or her performance (Bernier et al., 2009). Learning new skills to observe one's thoughts and feelings without needing to invest all of one's mental effort into controlling unwanted thoughts and feelings (Birrer & Morgan, 2010). This can help athletes become more involved in present moment experiences while promoting more adaptive responses to demands of the task at hand. In doing so, athletes who participante in MBIs and meditation can become better equipped to deal with stressors, benefiting both performance and ability to cope with stress.

Chapter Seven References

Aherne, C., Moran, A. P., & Lonsdale, C. (2011). The Effect of Mindfulness Training on Athletes' Flow: An Initial Investigation. *The Sport Psychologist*, *25*(2), 177–189. https://doi.org/10.1123/tsp.25.2.177

Akinola, M., & Mendes, W. B. (2012). Stress-induced cortisol facilitates threat-related decision making among police officers. *Behavioral Neuroscience*, *126*(1), 167–174. https://doi.org/10.1037/a0026657

Allen, M., Dietz, M., Blair, K. S., van Beek, M., Rees, G., Vestergaard-Poulsen, P., Lutz, A., & Roepstorff, A. (2012). Cognitive-Affective Neural Plasticity following Active-Controlled Mindfulness Intervention. *Journal of Neuroscience*, *32*(44), 15601–15610. https://doi.org/10.1523/jneurosci.2957-12.2012

Alsentali, A. M., & Anshel, M. H. (2015). Relationship between Internal and External Acute Stressors and Coping Style. *Relationship between Internal and External Acute Stressors and Coping Style.*, *38*(4), 357–375. http://eds.b.ebscohost.com/eds/pdfviewer/pdfviewer?vid=1&sid=e7e20de7-8b9e-4070-a618-4ce2b8bb727e%40pdc-v-sessmgr02

Anasori, E., Bayighomog, S. W., & Tanova, C. (2019). Workplace bullying, psychological distress, resilience, mindfulness, and emotional exhaustion. *The Service Industries Journal*, *40*(1–2), 65–89. https://doi.org/10.1080/02642069.2019.1589456

Andersen, J. P., Papazoglou, K., Koskelainen, M., Nyman, M., Gustafsberg, H., & Arnetz, B. B. (2015). Applying Resilience Promotion Training Among Special Forces Police

Officers. *SAGE Open*, *5*(2), 215824401559044. https://doi.org/10.1177/2158244015590446

Angelidis, A., Solis, E., Lautenbach, F., van der Does, W., & Putman, P. (2019). I'm going to fail! Acute cognitive performance anxiety increases threat-interference and impairs WM performance. *PLOS ONE*, *14*(2), e0210824. https://doi.org/10.1371/journal.pone.0210824

Anshel, M., & Anderson, D. (2002). Coping With Acute Stress in Sport: Linking Athletes' Coping Style, Coping Strategies, Affect, and Motor Performance. *Anxiety, Stress & Coping*, *15*(2), 193–209. https://doi.org/10.1080/10615800290028486

Arch, J. J., Eifert, G. H., Davies, C., Vilardaga, J. C. P., Rose, R. D., & Craske, M. G. (2012). Randomized clinical trial of cognitive behavioral therapy (CBT) versus acceptance and commitment therapy (ACT) for mixed anxiety disorders. *Journal of Consulting and Clinical Psychology*, *80*(5), 750–765. https://doi.org/10.1037/a0028310

Atchley, A. R. (2011). *An examination of the effects of mindfulness and task-relevant attentional focus on running performance*. (No. 1069). TopSCHOLAR. http://digitalcommons.wku.edu/theses/1069

Baer, R. A., Carmody, J., & Hunsinger, M. (2012). Weekly Change in Mindfulness and Perceived Stress in a Mindfulness-Based Stress Reduction Program. *Journal of Clinical Psychology*, *68*(7), 755–765. https://doi.org/10.1002/jclp.21865

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using Self-Report Assessment Methods to Explore Facets of Mindfulness. *Assessment*, *13*(1), 27–45. https://doi.org/10.1177/1073191105283504

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., Walsh, E., Duggan, D., & Williams, J. M. G. (2008). Construct Validity of the Five Facet Mindfulness Questionnaire in Meditating and Nonmeditating Samples. *Assessment*, *15*(3), 329–342. https://doi.org/10.1177/1073191107313003

Baer, R., Crane, C., Miller, E., & Kuyken, W. (2019). Doing no harm in mindfulness-based programs: Conceptual issues and empirical findings. *Clinical Psychology Review*, *71*, 101–114. https://doi.org/10.1016/j.cpr.2019.01.001

Bahramizade, H., & Besharat, M. A. (2010). The impact of styles of coping with stress on sport achievement. *Procedia - Social and Behavioral Sciences*, *5*, 764–769. https://doi.org/10.1016/j.sbspro.2010.07.181

Bali, A. (2015). Psychological Factors Affecting Sports Performance. *International Journal of Physical Education, Sports and Health*, *1*(6), 92–95. https://www.kheljournal.com/archives/2015/vol1issue6/PartB/1-5-77.pdf

Balters, S., Geeseman, J. W., Tveten, A.-K., Hildre, H. P., Ju, W., & Steinert, M. (2020). Mayday, Mayday, Mayday: Using salivary cortisol to detect distress (and eustress!) in critical incident training. *International Journal of Industrial Ergonomics*, *78*, 102975. https://doi.org/10.1016/j.ergon.2020.102975

Baltzell, A., Caraballo, N., Chipman, K., & Hayden, L. (2014). A Qualitative Study of the Mindfulness Meditation Training for Sport: Division I Female Soccer Players' Experience. *Journal of Clinical Sport Psychology*, *8*(3), 221–244. https://doi.org/10.1123/jcsp.2014-0030

Barnby, J. M., Bailey, N. W., Chambers, R., & Fitzgerald, P. B. (2015). How similar are the changes in neural activity resulting from mindfulness practice in contrast to spiritual practice? *Consciousness and Cognition*, *36*, 219–232. https://doi.org/10.1016/j.concog.2015.07.002

BEAUCHAINE, T. H. E. O. D. O. R. E. (2001). Vagal tone, development, and Gray's motivational theory: Toward an integratedmodel of autonomic nervous system functioning in psychopathology. <i>Development and Psychopathology, *13*(2), 183–214. https://doi.org/10.1017/s0954579401002012

Beilock, S. L., Afremow, J. A., Rabe, A. L., & Carr, T. H. (2001). "Don't Miss!" The Debilitating Effects of Suppressive Imagery on Golf Putting Performance. *Journal of Sport and Exercise Psychology*, *23*(3), 200–221. https://doi.org/10.1123/jsep.23.3.200

Beilock, S. L., Carr, T. H., MacMahon, C., & Starkes, J. L. (2002). When paying attention becomes counterproductive: Impact of divided versus skill-focused attention on novice and experienced performance of sensorimotor skills. *Journal of Experimental Psychology: Applied*, *8*(1), 6–16. https://doi.org/10.1037/1076-898x.8.1.6

Bernier, M., Thienot, E., Codron, R., & Fournier, J. F. (2009). Mindfulness and Acceptance Approaches in Sport Performance. *Journal of Clinical Sport Psychology*, *3*(4), 320–333. https://doi.org/10.1123/jcsp.3.4.320

Binsch, O., Oudejans, R. R. D., Bakker, F. C., & Savelsbergh, G. J. P. (2009). Unwanted effects in aiming actions: The relationship between gaze behavior and performance in a golf putting task. *Psychology of Sport and Exercise*, *10*(6), 628–635. https://doi.org/10.1016/j.psychsport.2009.05.005

Birnie, K., Speca, M., & Carlson, L. E. (2010). Exploring self-compassion and empathy in the context of mindfulness-based stress reduction (MBSR). *Stress and Health*, *26*(5), 359–371. https://doi.org/10.1002/smi.1305

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

Birrer, D., Röthlin, P., & Morgan, G. (2012). Mindfulness to Enhance Athletic Performance: Theoretical Considerations and Possible Impact Mechanisms. *Mindfulness*, *3*(3), 235–246. https://doi.org/10.1007/s12671-012-0109-2

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., Segal, Z. V., Abbey, S., Speca, M., Velting, D., & Devins, G. (2006). Mindfulness: A Proposed Operational Definition. *Clinical Psychology: Science and Practice*, *11*(3), 230–241. https://doi.org/10.1093/clipsy.bph077

Blackledge, J. T. (2007). Disrupting Verbal Processes: Cognitive Defusion in Acceptance and Commitment Therapy and Other Mindfulness-Based Psychotherapies. *The Psychological Record*, *57*(4), 555–576. https://doi.org/10.1007/bf03395595

Bond, F. W., Hayes, S. C., Baer, R. A., Carpenter, K. M., Guenole, N., Orcutt, H. K., Waltz, T., & Zettle, R. D. (2011). Preliminary Psychometric Properties of the Acceptance and Action Questionnaire–II: A Revised Measure of Psychological Inflexibility and Experiential Avoidance. *Behavior Therapy*, *42*(4), 676–688. https://doi.org/10.1016/j.beth.2011.03.007

Bostock, S., Crosswell, A. D., Prather, A. A., & Steptoe, A. (2019). Mindfulness on-the-go: Effects of a mindfulness meditation app on work stress and well-being. *Journal of Occupational Health Psychology*, *24*(1), 127–138. https://doi.org/10.1037/ocp0000118

Bowen, S., & Kurz, A. S. (2011a). Between-Session Practice and Therapeutic Alliance as Predictors of Mindfulness After Mindfulness-Based Relapse Prevention. *Journal of Clinical Psychology*, *68*(3), 236–245. https://doi.org/10.1002/jclp.20855

Bowen, S., & Kurz, A. S. (2011b). Between-Session Practice and Therapeutic Alliance as Predictors of Mindfulness After Mindfulness-Based Relapse Prevention. *Journal of Clinical Psychology*, *68*(3), 236–245. https://doi.org/10.1002/jclp.20855

Bränström, R., Duncan, L. G., & Moskowitz, J. T. (2011). The association between dispositional mindfulness, psychological well-being, and perceived health in a Swedish population-based sample. *British Journal of Health Psychology*, *16*(2), 300–316. https://doi.org/10.1348/135910710x501683

Brinley, J. F., Jovick, T. J., & McLaughlin, L. M. (1974). Age, Reasoning, and Memory in Adults. *Journal of Gerontology*, *29*(2), 182–189. https://doi.org/10.1093/geronj/29.2.182

Brisbon, N. M., & Lowery, G. A. (2009). Mindfulness and Levels of Stress: A Comparison of Beginner and Advanced Hatha Yoga Practitioners. *Journal of Religion and Health*, *50*(4), 931–941. https://doi.org/10.1007/s10943-009-9305-3

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, *84*(4), 822–848. https://doi.org/10.1037/0022-3514.84.4.822

Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical Foundations and Evidence for its Salutary Effects. *Psychological Inquiry*, *18*(4), 211–237. https://doi.org/10.1080/10478400701598298

Bühlmayer, L., Birrer, D., Röthlin, P., Faude, O., & Donath, L. (2017). Effects of Mindfulness Practice on Performance-Relevant Parameters and Performance Outcomes in Sports: A Meta-Analytical Review. *Sports Medicine*, *47*(11), 2309–2321. https://doi.org/10.1007/s40279-017-0752-9

Bulğay, C., Tingaz, E. O., Bayraktar, I. ş. ı., & Çetin, E. (2020). Athletic performance and mindfulness in track and field athletes. *Current Psychology*, 157–169. https://doi.org/10.1007/s12144-020-00967-y

Burlot, F., Richard, R., & Joncheray, H. (2016). The life of high-level athletes: The challenge of high performance against the time constraint. *International Review for the Sociology of Sport*, *53*(2), 234–249. https://doi.org/10.1177/1012690216647196

Burns, M. K. (2012). Meta-Analysis of Single-Case Design Research: Introduction to the Special Issue. *Journal of Behavioral Education*, *21*(3), 175–184. https://doi.org/10.1007/s10864-012-9158-9

Burton, A., Burgess, C., Dean, S., Koutsopoulou, G. Z., & Hugh-Jones, S. (2016). How Effective are Mindfulness-Based Interventions for Reducing Stress Among Healthcare Professionals? A Systematic Review and Meta-Analysis. *Stress and Health*, *33*(1), 3–13. https://doi.org/10.1002/smi.2673

Cathcart, S., McGregor, M., & Groundwater, E. (2014). Mindfulness and Flow in Elite Athletes. *Journal of Clinical Sport Psychology*, *8*(2), 119–141. https://doi.org/10.1123/jcsp.2014-0018

Carlson, L. E., & Brown, K. W. (2005). Validation of the Mindful Attention Awareness Scale in a cancer population. *Journal of Psychosomatic Research*, *58*(1), 29–33. https://doi.org/10.1016/j.jpsychores.2004.04.366

Carmody, J., & Baer, R. A. (2007). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine*, *31*(1), 23–33. https://doi.org/10.1007/s10865-007-9130-7

Carrança, B., Serpa, S., Rosado, A., & Guerrero, J. P. (2019). Mindfulness and Compassion Strategies on Elite Soccer: Conceptualization of Mindfulness-Based Soccer Program (MBSoccerP). *Biomedical Journal of Scientific & Technical Research*, *14*(2), 34–40. https://doi.org/10.26717/bjstr.2019.14.002529

Castonguay, L. G., & Beutler, L. E. (2005). *Principles of Therapeutic Change that Work (Oxford Series in Clinical Psychology)* (1st ed.). Oxford University Press.

Cavanagh, K., Strauss, C., Cicconi, F., Griffiths, N., Wyper, A., & Jones, F. (2013). A randomised controlled trial of a brief online mindfulness-based intervention. *Behaviour Research and Therapy*, *51*(9), 573–578. https://doi.org/10.1016/j.brat.2013.06.003

Cayoun, B. A. (2011). *Mindfulness-integrated CBT: Principles and Practice* (1st ed.). Wiley-Blackwell.

Cayoun, B. A., Francis, S. E., & Shires, A. G. (2018). *The Clinical Handbook of Mindfulness-integrated Cognitive Behavior Therapy: A Step-by-Step Guide for Therapists* (1st ed.). Wiley-Blackwell.

Cebolla, A., Demarzo, M., Martins, P., Soler, J., & Garcia-Campayo, J. (2017). Unwanted effects: Is there a negative side of meditation? A multicentre survey. *PLOS ONE*, *12*(9), e0183137. https://doi.org/10.1371/journal.pone.0183137

Cerqueira, J. J., Mailliet, F., Almeida, O. F. X., Jay, T. M., & Sousa, N. (2007). The Prefrontal Cortex as a Key Target of the Maladaptive Response to Stress. *Journal of Neuroscience*, *27*(11), 2781–2787. https://doi.org/10.1523/jneurosci.4372-06.2007

Chambers, R., Gullone, E., & Allen, N. B. (2009). Mindful emotion regulation: An integrative review. *Clinical Psychology Review*, *29*(6), 560–572. https://doi.org/10.1016/j.cpr.2009.06.005

Chambers, R., Lo, B. C. Y., & Allen, N. B. (2007). The Impact of Intensive Mindfulness Training on Attentional Control, Cognitive Style, and Affect. *Cognitive Therapy and Research*, *32*(3), 303–322. https://doi.org/10.1007/s10608-007-9119-0

Chambless, D. L., & Hollon, S. D. (1998). Defining empirically supported therapies. *Journal of Consulting and Clinical Psychology*, *66*(1), 7–18. https://doi.org/10.1037/0022-006x.66.1.7

Champion, L., Economides, M., & Chandler, C. (2018). The efficacy of a brief app-based mindfulness intervention on psychosocial outcomes in healthy adults: A pilot randomised controlled trial. *PLOS ONE*, *13*(12), e0209482. https://doi.org/10.1371/journal.pone.0209482

Chang, E. C.-H., Chu, C.-H., Karageorghis, C. I., Wang, C.-C., Tsai, J. H.-C., Wang, Y.-S., & Chang, Y.-K. (2017). Relationship between mode of sport training and general cognitive performance. *Journal of Sport and Health Science*, *6*(1), 89–95. https://doi.org/10.1016/j.jshs.2015.07.007

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

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

Ciarrochi, J., Bilich, L., & Godsell, C. (2010). Psychological flexibility as a mechanism of change in acceptance and commitment therapy. In R. Baer (Ed.), *Assessing mindfulness and acceptance processes in clients: Illuminating the theory and practice of change*. (pp.51–76). Oakland, CA: New Harbinger Publications.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A Global Measure of Perceived Stress. *Journal of Health and Social Behavior*, *24*(4), 385. https://doi.org/10.2307/2136404

Cohen, J. (2007). A power primer. *Tutorials in Quantitative Methods for Psychology*, *3*(2), 79. https://doi.org/10.20982/tqmp.03.2.p079

Cordon, S. L., Brown, K. W., & Gibson, P. R. (2009). The Role of Mindfulness-Based Stress Reduction on Perceived Stress: Preliminary Evidence for the Moderating Role of

Attachment Style. *Journal of Cognitive Psychotherapy*, *23*(3), 258–269. https://doi.org/10.1891/0889-8391.23.3.258

Cosh, S., & Tully, P. J. (2014). "All I have to do is pass": A discursive analysis of student athletes' talk about prioritising sport to the detriment of education to overcome stressors encountered in combining elite sport and tertiary education. *Psychology of Sport and Exercise*, *15*(2), 180–189. https://doi.org/10.1016/j.psychsport.2013.10.015

Cosh, S., & Tully, P. J. (2015). Stressors, Coping, and Support Mechanisms for Student Athletes Combining Elite Sport and Tertiary Education: Implications for Practice. *The Sport Psychologist*, *29*(2), 120–133. https://doi.org/10.1123/tsp.2014-0102

Crum, A. J., Jamieson, J. P., & Akinola, M. (2020). Optimizing stress: An integrated intervention for regulating stress responses. *Emotion*, *20*(1), 120–125. https://doi.org/10.1037/emo0000670

Csikszentmihalyi, M., & LeFevre, J. (1989). Optimal experience in work and leisure. *Journal of Personality and Social Psychology*, *56*(5), 815–822. https://doi.org/10.1037/0022-3514.56.5.815

Cullen, M. (2011). Mindfulness-Based Interventions: An Emerging Phenomenon. *Mindfulness*, *2*(3), 186–193. https://doi.org/10.1007/s12671-011-0058-1

Dallery, J., & Raiff, B. R. (2014). Optimizing behavioral health interventions with single-case designs: from development to dissemination. *Translational Behavioral Medicine*, *4*(3), 290–303. https://doi.org/10.1007/s13142-014-0258-z

De Francisco, C., Arce, C., Vílchez, M. P., & Vales, Á. (2016). Antecedents and consequences of burnout in athletes: Perceived stress and depression. *International*

Journal of Clinical and Health Psychology, *16*(3), 239–246. https://doi.org/10.1016/j.ijchp.2016.04.001

De Petrillo, L. A., Kaufman, K. A., Glass, C. R., & Arnkoff, D. B. (2009). Mindfulness for Long-Distance Runners: An Open Trial Using Mindful Sport Performance Enhancement (MSPE). *Journal of Clinical Sport Psychology*, *3*(4), 357–376. https://doi.org/10.1123/jcsp.3.4.357

de Terte, I., Becker, J., & Stephens, C. (2009). An Integrated Model for Understanding and Developing Resilience in the Face of Adverse Events. *Journal of Pacific Rim Psychology*, *3*(1), 20–26. https://doi.org/10.1375/prp.3.1.20

Dehghani, M., Delbar Saf, A., Vosoughi, A., Tebbenouri, G., & Ghazanfari Zarnagh, H. (2018). Effectiveness of the mindfulness-acceptance-commitment-based approach on athletic performance and sports competition anxiety: a randomized clinical trial. *Electronic Physician*, *10*(5), 6749–6755. https://doi.org/10.19082/6749

Desai, R., Tailor, A., & Bhatt, T. (2015). Effects of yoga on brain waves and structural activation: A review. *Complementary Therapies in Clinical Practice*, *21*(2), 112–118. https://doi.org/10.1016/j.ctcp.2015.02.002

Desbordes, G., Gard, T., Hoge, E. A., Hölzel, B. K., Kerr, C., Lazar, S. W., Olendzki, A., & Vago, D. R. (2014). Moving Beyond Mindfulness: Defining Equanimity as an Outcome Measure in Meditation and Contemplative Research. *Mindfulness*, *6*(2), 356–372. https://doi.org/10.1007/s12671-013-0269-8

Dhabhar, F. S. (2018). The short-term stress response – Mother nature's mechanism for enhancing protection and performance under conditions of threat, challenge, and

opportunity. *Frontiers in Neuroendocrinology*, *49*, 175–192. https://doi.org/10.1016/j.yfrne.2018.03.004

di Fronso, S., Costa, S., Montesano, C., Di Gruttola, F., Ciofi, E. G., Morgilli, L., Robazza, C., & Bertollo, M. (2020). The effects of COVID-19 pandemic on perceived stress and psychobiosocial states in Italian athletes. *International Journal of Sport and Exercise Psychology*, 1–13. https://doi.org/10.1080/1612197x.2020.1802612

Donald, J. N., Atkins, P. W. B., Parker, P. D., Christie, A. M., & Ryan, R. M. (2016). Daily stress and the benefits of mindfulness: Examining the daily and longitudinal relations between present-moment awareness and stress responses. *Journal of Research in Personality*, *65*, 30–37. https://doi.org/10.1016/j.jrp.2016.09.002

Dugdale, J. R., Eklund, R. C., & Gordon, S. (2002). Expected and Unexpected Stressors in Major International Competition: Appraisal, Coping, and Performance. *The Sport Psychologist*, *16*(1), 20–33. https://doi.org/10.1123/tsp.16.1.20

Dunn, M. (2014). Understanding athlete wellbeing: The views of national sporting and player associations. *Journal of Science and Medicine in Sport*, *18*, e132–e133. https://doi.org/10.1016/j.jsams.2014.11.118

Eatough, E. M. (2015). How Does Employee Mindfulness Reduce Psychological Distress? *Industrial and Organizational Psychology*, *8*(4), 643–647. https://doi.org/10.1017/iop.2015.93

Economides, M., Martman, J., Bell, M. J., & Sanderson, B. (2018). Improvements in Stress, Affect, and Irritability Following Brief Use of a Mindfulness-based Smartphone App:

A Randomized Controlled Trial. *Mindfulness*, *9*(5), 1584–1593. https://doi.org/10.1007/s12671-018-0905-4

Eifert, G. H., & Forsyth, J. P. (2005). *Acceptance and Commitment Therapy for Anxiety Disorders: A Practitioner's Treatment Guide to Using Mindfulness, Acceptance, and Values-Based Behavior Change* (Vol. 1) [E-book]. New Harbinger Publications. https://pingsso.ebscohost.com/sp/ACS.saml2

Evans, L., Wadey, R., Hanton, S., & Mitchell, I. (2012). Stressors experienced by injured athletes. *Journal of Sports Sciences*, *30*(9), 917–927. https://doi.org/10.1080/02640414.2012.682078

Faraone, S. V. (2008). Interpreting estimates of treatment effects: implications for managed care. *P & T : A Peer-Reviewed Journal for Formulary Management*, *33*(12), 700–11. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19750051

Faizan, R., & Haque, A. (2019). Working Efficiency of Contrasting Genders under Eustress, Distress, Hyper-Stress, and Hypo-Stress. *Prabandhan: Indian Journal of Management*, *12*(11), 32. https://doi.org/10.17010/pijom/2019/v12i11/148411

Fares, J., Al Tabosh, H., Saadeddin, Z., El Mouhayyar, C., & Aridi, H. (2016). Stress, burnout and coping strategies in preclinical medical students. *North American Journal of Medical Sciences*, *8*(2), 75. https://doi.org/10.4103/1947-2714.177299

Ferssizidis, P., Adams, L. M., Kashdan, T. B., Plummer, C., Mishra, A., & Ciarrochi, J. (2010). Motivation for and commitment to social values: The roles of age and gender. *Motivation and Emotion*, *34*(4), 354–362. https://doi.org/10.1007/s11031-010-9187-4

Fletcher, L., & Hayes, S. C. (2005). Relational frame theory, acceptance and commitment therapy, and a functional analytic definition of mindfulness. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, *23*(4), 315–336. https://doi.org/10.1007/s10942-005-0017-7

Flett, J. A. M., Conner, T. S., Riordan, B. C., Patterson, T., & Hayne, H. (2020). App-based mindfulness meditation for psychological distress and adjustment to college in incoming university students: a pragmatic, randomised, waitlist-controlled trial. *Psychology & Health*, *35*(9), 1049–1074. https://doi.org/10.1080/08870446.2019.1711089

Flett, J. A. M., Hayne, H., Riordan, B. C., Thompson, L. M., & Conner, T. S. (2018). Mobile Mindfulness Meditation: a Randomised Controlled Trial of the Effect of Two Popular Apps on Mental Health. *Mindfulness*, *10*(5), 863–876. https://doi.org/10.1007/s12671-018-1050-9

Frentz, D. M., McHugh, T.-L. F., & Mosewich, A. D. (2019). Athletes' Experiences of Shifting From Self-Critical toSelf-Compassionate Approaches Within High-Performance Sport. *Journal of Applied Sport Psychology*, *32*(6), 565–584. https://doi.org/10.1080/10413200.2019.1608332

Fritz, M. S., & MacKinnon, D. P. (2007). Required Sample Size to Detect the Mediated Effect. *Psychological Science*, *18*(3), 233–239. https://doi.org/10.1111/j.1467-9280.2007.01882.x

Furrer, P., Moen, F., & Firing, K. (2015). How Mindfulness Training may mediate Stress, Performance and Burnout. *Sport Journal*, 1.

Gallo, K. P., Comer, J. S., & Barlow, D. H. (2013). Single-Case Experimental Designs and Small Pilot Trial Designs. *Oxford Handbooks Online*, 1–90. https://doi.org/10.1093/oxfordhb/9780199793549.013.0003

Gamaiunova, L., Brandt, P.-Y., Bondolfi, G., & Kliegel, M. (2019). Exploration of psychological mechanisms of the reduced stress response in long-term meditation practitioners. *Psychoneuroendocrinology*, *104*, 143–151. https://doi.org/10.1016/j.psyneuen.2019.02.026

Gardner, F. L. (2009). Efficacy, Mechanisms of Change, and the Scientific Development of Sport Psychology. *Journal of Clinical Sport Psychology*, *3*(2), 139–155. https://doi.org/10.1123/jcsp.3.2.139

Gardner, F. L. (2016). Scientific Advancements of Mindfulness- and Acceptance-Based Models in Sport Psychology: A Decade in Time, a Seismic Shift in Philosophy and Practice. *Mindfulness and Performance*, 127–152. https://doi.org/10.1017/cbo9781139871310.008

Gardner, F., & Moore, Z. (2005). *Clinical Sport Psychology* (First ed.). Human Kinetics.

Gardner, F., & Moore, Z. E. (2007). *The Psychology of Enhancing Human Performance: The Mindfulness-Acceptance-Commitment Approach* (1st ed.). Springer Publishing Company.

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

Garland, E., Gaylord, S., & Park, J. (2009). The Role of Mindfulness in Positive Reappraisal. *EXPLORE*, *5*(1), 37–44. https://doi.org/10.1016/j.explore.2008.10.001

Garland, E. L., Hanley, A., Farb, N. A., & Froeliger, B. (2015). State Mindfulness During Meditation Predicts Enhanced Cognitive Reappraisal. *Mindfulness*, *6*(2), 234–242. https://doi.org/10.1007/s12671-013-0250-6

Giges, B., & Reid, G. (2016). Awareness, Self-Awareness, and Mindfulness: The Application of Theory to Practice. *Mindfulness and Performance*, 488–512. https://doi.org/10.1017/cbo9781139871310.022

Glomb, T. M., Duffy, M. K., J.E, B., & Yang, T. (2011). Mindfulness at Work. *Research in Personnel and Human Resources Management*, *30*, 115–157. https://www.researchgate.net/profile/Theresa_Glomb/publication/306395800_Mindfulness_at_Work/links/54e4aee90cf276cec171f113.pdf

Goedendorp, M. M., & Steverink, N. (2016). Interventions based on self-management of well-being theory: pooling data to demonstrate mediation and ceiling effects, and to compare formats. *Aging & Mental Health*, *21*(9), 947–953. https://doi.org/10.1080/13607863.2016.1182967

Goodman, F. R., Kashdan, T. B., Mallard, T. T., & Schumann, M. (2014). A brief mindfulness and yoga intervention with an entire NCAA Division I athletic team: An initial investigation. *Psychology of Consciousness: Theory, Research, and Practice*, *1*(4), 339–356. https://doi.org/10.1037/cns0000022

Gotink, R. A., Meijboom, R., Vernooij, M. W., Smits, M., & Hunink, M. G. M. (2016). 8-week Mindfulness Based Stress Reduction induces brain changes similar to traditional long-term meditation practice – A systematic review. *Brain and Cognition*, *108*, 32–41. https://doi.org/10.1016/j.bandc.2016.07.001

Gould, D., Finch, L. M., & Jackson, S. A. (1993). Coping Strategies Used by National Champion Figure Skaters. *Research Quarterly for Exercise and Sport*, *64*(4), 453–468. https://doi.org/10.1080/02701367.1993.10607599

Gould, D., Weiss, M., & Weinberg, R. (1981). Psychological Characteristics of Successful and Nonsuccessful Big Ten Wrestlers. *Journal of Sport Psychology*, *3*(1), 69–81. https://doi.org/10.1123/jsp.3.1.69

Goyal, M., Singh, S., Sibinga, E. M., Gould, N. F., Rowland-Seymour, A., Sharma, R., Berger, Z., Sleicher, D., Maron, D. D., Shihab, H. M., Ranasinghe, P. D., Linn, S., Saha, S., Bass, E. B., Haythornthwaite, J. A., & Cramer, H. (2014). Meditation Programs for Psychological Stress and Well-being: A Systematic Review and Meta-analysis. *Deutsche Zeitschrift Für Akupunktur*, *57*(3), 26–27. https://doi.org/10.1016/j.dza.2014.07.007

Granberg, A. M. K. F. (2018). *A randomised controlled trial of a mindfulness-based mobile app evaluating mindfulness, perceived stress, wellbeing and emotion reactivity*. Massey University. https://mro.massey.ac.nz/handle/10179/14681

Gross, M., Moore, Z. E., Gardner, F. L., Wolanin, A. T., Pess, R., & Marks, D. R. (2016). An empirical examination comparing the Mindfulness-Acceptance-Commitment approach and Psychological Skills Training for the mental health and sport performance of female student athletes. *International Journal of Sport and Exercise Psychology*, *16*(4), 431–451. https://doi.org/10.1080/1612197x.2016.1250802

Gu, J., Strauss, C., Bond, R., & Cavanagh, K. (2016). Corrigendum to "How do Mindfulness-Based Cognitive Therapy and Mindfulness-Based Stress Reduction Improve Mental Health and Wellbeing? A Systematic Review and Meta-Analysis of Mediation

Studies" [Clinical Psychology Review 37 (2015) 1–12]. *Clinical Psychology Review*, *49*, 119. https://doi.org/10.1016/j.cpr.2016.09.011

Gustafsson, H., Skoog, T., Davis, P., Kenttä, G., & Haberl, P. (2015). Mindfulness and Its Relationship With Perceived Stress, Affect, and Burnout in Elite Junior Athletes. *Journal of Clinical Sport Psychology*, *9*(3), 263–281. https://doi.org/10.1123/jcsp.2014-0051

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

Gutshall, C. L., Hampton, D. P., Sebetan, I. M., Stein, P. C., & Broxtermann, T. J. (2017). The effects of occupational stress on cognitive performance in police officers. *Police Practice and Research*, *18*(5), 463–477. https://doi.org/10.1080/15614263.2017.1288120

Halbesleben, J. R. B., Neveu, J.-P., Paustian-Underdahl, S. C., & Westman, M. (2014). Getting to the "COR" understanding the role of resources in conservation of resources theory. *Journal of Management*, *40*(5), 1334–1364. https://doi.org/10.1177/0149206314527130

Hardy, L., Mullen, R., & Martin, N. (2001). Effect of Task-Relevant Cues and State Anxiety on Motor Performance. *Perceptual and Motor Skills*, *92*(3), 943–946. https://doi.org/10.2466/pms.2001.92.3.943

Hargrove, M. B., Nelson, D. L., & Cooper, C. L. (2013). Generating eustress by challenging employees. *Organizational Dynamics*, *42*(1), 61–69. https://doi.org/10.1016/j.orgdyn.2012.12.008

Harmison, R. J. (2006). Peak Performance in Sport: Identifying Ideal Performance States and Developing Athletes' Psychological Skills. *Professional Psychology: Research and Practice*, *37*(3), 233–243. https://doi.org/10.1037/0735-7028.37.3.233

Harung, H. S., Travis, F., Pensgaard, A. M., Boes, R., Cook-Greuter, S., & Daley, K. (2011). Higher psycho-physiological refinement in world-class Norwegian athletes: brain measures of performance capacity. *Scandinavian Journal of Medicine & Science in Sports*, *21*(1), 32–41. https://doi.org/10.1111/j.1600-0838.2009.01007.x

Hasker, S. M. (2010). *Evaluation of the mindfulness- acceptance-commitment (MAC) approach for enhancing athletic performance*. (No. 3413164). Indiana University. https://search.proquest.com/openview/60583bfcb65bc109c36d192035ff044c/1?pq-origsite=gscholar&cbl=18750&diss=y

Hayes, S. C., Follette, V. M., & Linehan, M. M. (2004). *Mindfulness and Acceptance: Expanding the Cognitive-Behavioral Tradition* (1st ed.). The Guilford Press.

Hayes, S. C., Levin, M. E., Plumb-Vilardaga, J., Villatte, J. L., & Pistorello, J. (2013). Acceptance and Commitment Therapy and Contextual Behavioral Science: Examining the Progress of a Distinctive Model of Behavioral and Cognitive Therapy. *Behavior Therapy*, *44*(2), 180–198. https://doi.org/10.1016/j.beth.2009.08.002

Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and Commitment Therapy: Model, processes and outcomes. *Behaviour Research and Therapy*, *44*(1), 1–25. https://doi.org/10.1016/j.brat.2005.06.006

Hayes, S. C., Strosahl, K., Wilson, K. G., Bissett, R. T., Pistorello, J., Toarmino, D., Polusny, M. A., Dykstra, T. A., Batten, S. V., Bergan, J., Stewart, S. H., Zvolensky, M. J., Eifert, G. H., Bond, F. W., Forsyth, J. P., Karekla, M., & McCurry, S. M. (2004). Measuring experiential avoidance: A preliminary test of a working model. *The Psychological Record*, *54*(4), 553–578. https://doi.org/10.1007/bf03395492

Heinen, I., Bullinger, M., & Kocalevent, R.-D. (2017). Perceived stress in first year medical students - associations with personal resources and emotional distress. *BMC Medical Education*, *17*(1), 1–14. https://doi.org/10.1186/s12909-016-0841-8

Hendricks, D. S., Lavery, M. R., Bouillon, L. E., & Gotfried, R. S. (2019). Evaluating the Effectiveness of a Mindfulness App Among Academic Advisors. *Journal of Technology in Behavioral Science*, *5*(2), 149–155. https://doi.org/10.1007/s41347-019-00122-w

Henriksen, K., Hansen, J., & Larsen, C. H. (2019). *Mindfulness and Acceptance in Sport: How to Help Athletes Perform and Thrive under Pressure* (1st ed.). Routledge.

Hernández, S. E., Suero, J., Barros, A., González-Mora, J. L., & Rubia, K. (2016). Increased Grey Matter Associated with Long-Term Sahaja Yoga Meditation: A Voxel-Based Morphometry Study. *PLOS ONE*, *11*(3), e0150757. https://doi.org/10.1371/journal.pone.0150757

Hofmann, S. G., & Asmundson, G. J. G. (2008). Acceptance and mindfulness-based therapy: New wave or old hat? *Clinical Psychology Review*, *28*(1), 1–16. https://doi.org/10.1016/j.cpr.2007.09.003

Hofmann, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting and Clinical Psychology*, *78*(2), 169–183. https://doi.org/10.1037/a0018555

Hölzel, B. K., Carmody, J., Vangel, M., Congleton, C., Yerramsetti, S. M., Gard, T., & Lazar, S. W. (2011). Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Research: Neuroimaging*, *191*(1), 36–43. https://doi.org/10.1016/j.pscychresns.2010.08.006

Huberty, J., Green, J., Glissmann, C., Larkey, L., Puzia, M., & Lee, C. (2019). Efficacy of the Mindfulness Meditation Mobile App "Calm" to Reduce Stress Among College Students: Randomized Controlled Trial. *JMIR MHealth and UHealth*, *7*(6), e14273. https://doi.org/10.2196/14273

Hutton, J. P., Maldonado, M., Kuyken, W., Hunter, J., & Newman, K. (2019, October 22). *The Challenge of Certifying Mindfulness Teachers*. Mindful.Org. https://www.mindful.org/the-challenge-of-certifying-mindfulness-teachers/

Hyland, P. K., Lee, R. A., & Mills, M. J. (2015). Mindfulness at Work: A New Approach to Improving Individual and Organizational Performance. *Industrial and Organizational Psychology*, *8*(4), 576–602. https://doi.org/10.1017/iop.2015.41

Hyland, T. (2017). McDonaldizing spirituality: Mindfulness, education, and consumerism. *Journal of Transformative Education*, *15*(4), 334–356. https://doi.org/10.1177/1541344617696972

Ingstrup, M. S., Mosewich, A. D., & Holt, N. L. (2017). The Development of Self-Compassion Among Women Varsity Athletes. *The Sport Psychologist*, *31*(4), 317–331. https://doi.org/10.1123/tsp.2016-0147

IsHak, W., Nikravesh, R., Lederer, S., Perry, R., Ogunyemi, D., & Bernstein, C. (2013). Burnout in medical students: a systematic review. *The Clinical Teacher*, *10*(4), 242–245. https://doi.org/10.1111/tct.12014

Jackson, R. C., Warren, S., & Abernethy, B. (2006). Anticipation skill and susceptibility to deceptive movement. *Acta Psychologica*, *123*(3), 355–371. https://doi.org/10.1016/j.actpsy.2006.02.002

Jackson, S. A., & Marsh, H. W. (1996). Development and Validation of a Scale to Measure Optimal Experience: The Flow State Scale. *Journal of Sport and Exercise Psychology*, *18*(1), 17–35. https://doi.org/10.1123/jsep.18.1.17

Janelle, C. M. (1999). Ironic Mental Processes in Sport: Implications for Sport Psychologists. *The Sport Psychologist*, *13*(2), 201–220. https://doi.org/10.1123/tsp.13.2.201

Jaret, P., Hutton, S., Maldonado, M., Kuyken, W., Hunter, J., & Newman, K. (2019, October 22). *The Challenge of Certifying Mindfulness Teachers*. Mindful. https://www.mindful.org/the-challenge-of-certifying-mindfulness-teachers/

Johles, L., Gustafsson, H., Jansson-Fröjmark, M., Classon, C., Hasselqvist, J., & Lundgren, T. (2020). Psychological Flexibility Among Competitive Athletes: A Psychometric Investigation of a New Scale. *Frontiers in Sports and Active Living*, *2*, 110. https://doi.org/10.3389/fspor.2020.00110

Jones, B. J., Kaur, S., Miller, M., & Spencer, R. M. C. (2020). Mindfulness-Based Stress Reduction Benefits Psychological Well-Being, Sleep Quality, and Athletic Performance in Female Collegiate Rowers. *Frontiers in Psychology*, *11*, 2373. https://doi.org/10.3389/fpsyg.2020.572980

Jones, D. R., Graham-Engeland, J. E., Smyth, J. M., & Lehman, B. J. (2018). Clarifying the Associations between Mindfulness Meditation and Emotion: Daily High- and Low-arousal Emotions and Emotional Variability. *Applied Psychology: Health and Well-Being*, *10*(3), 504–523. https://doi.org/10.1111/aphw.12135

Jones, D. R., Lehman, B. J., Noriega, A., & Dinnel, D. L. (2019). The effects of a short-term mindfulness meditation intervention on coping flexibility. *Anxiety, Stress, & Coping*, *32*(4), 347–361. https://doi.org/10.1080/10615806.2019.1596672

Josefsson, T., Ivarsson, A., Gustafsson, H., Stenling, A., Lindwall, M., Tornberg, R., & Böröy, J. (2019). Effects of Mindfulness-Acceptance-Commitment (MAC) on Sport-Specific Dispositional Mindfulness, Emotion Regulation, and Self-Rated Athletic Performance in a Multiple-Sport Population: an RCT Study. *Mindfulness*, *10*(8), 1518–1529. https://doi.org/10.1007/s12671-019-01098-7

Jouper, J., & Gustafsson, H. (2013). Mindful Recovery: A Case Study of a Burned-Out Elite Shooter. *The Sport Psychologist*, *27*(1), 92–102. https://doi.org/10.1123/tsp.27.1.92

Kabat-Zinn, J. (2003). Mindfulness-Based Interventions in Context: Past, Present, and Future. *Clinical Psychology: Science and Practice*, *10*(2), 144–156. https://doi.org/10.1093/clipsy.bpg016

Kang, E.-K., Lihm, H.-S., & Kong, E.-H. (2013). Association of Intern and Resident Burnout with Self-Reported Medical Errors. *Korean Journal of Family Medicine*, *34*(1), 36. https://doi.org/10.4082/kjfm.2013.34.1.36

Kappen, G., Karremans, J. C., & Burk, W. J. (2019). Effects of a Short Online Mindfulness Intervention on Relationship Satisfaction and Partner Acceptance: the Moderating Role of Trait Mindfulness. *Mindfulness*, *10*(10), 2186–2199. https://doi.org/10.1007/s12671-019-01174-y

Karlin, B. E., Walser, R. D., Yesavage, J., Zhang, A., Trockel, M., & Taylor, C. B. (2013). Effectiveness of acceptance and commitment therapy for depression: Comparison among older and younger veterans. *Aging & Mental Health*, *17*(5), 555–563. https://doi.org/10.1080/13607863.2013.789002

Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical Psychology Review*, *30*(7), 865–878. https://doi.org/10.1016/j.cpr.2010.03.001

Katz, B. R., & Lattal, K. A. (2020). What is an extinction burst?: A case study in the analysis of transitional behavior. *Journal of the Experimental Analysis of Behavior*, *115*(1), 129–140. https://doi.org/10.1002/jeab.642

Kaufman, K. A., Glass, C. R., & Arnkoff, D. B. (2009). Evaluation of Mindful Sport Performance Enhancement (MSPE): A New Approach to Promote Flow in Athletes.

Journal of Clinical Sport Psychology, *3*(4), 334–356. https://doi.org/10.1123/jcsp.3.4.334

Kausar, R. (2010). Perceived Stress, Academic Workloads and Use of Coping Strategies by University Students. *Journal of Behavioural Sciences*, *20*(1), 31–45. http://eds.a.ebscohost.com/eds/pdfviewer/pdfviewer?vid=2&sid=e3488d69-d236-4118-b04e-c56a675870e5%40sdc-v-sessmgr02

Kelly, M. M., Tyrka, A. R., Anderson, G. M., Price, L. H., & Carpenter, L. L. (2008). Sex differences in emotional and physiological responses to the Trier Social Stress Test. *Journal of Behavior Therapy and Experimental Psychiatry*, *39*(1), 87–98. https://doi.org/10.1016/j.jbtep.2007.02.003

Khoury, B., Lecomte, T., Fortin, G., Masse, M., Therien, P., Bouchard, V., Chapleau, M.-A., Paquin, K., & Hofmann, S. G. (2013). Mindfulness-based therapy: A comprehensive meta-analysis. *Clinical Psychology Review*, *33*(6), 763–771. https://doi.org/10.1016/j.cpr.2013.05.005

Kilpatrick, L. A., Suyenobu, B. Y., Smith, S. R., Bueller, J. A., Goodman, T., Creswell, J. D., Tillisch, K., Mayer, E. A., & Naliboff, B. D. (2011). Impact of mindfulness-based stress reduction training on intrinsic brain connectivity. *NeuroImage*, *56*(1), 290–298. https://doi.org/10.1016/j.neuroimage.2011.02.034

Kinrade, N. P., Jackson, R. C., & Ashford, K. J. (2010). Dispositional reinvestment and skill failure in cognitive and motor tasks. *Psychology of Sport and Exercise*, *11*(4), 312–319. https://doi.org/10.1016/j.psychsport.2010.02.005

Koch, A. K., Schöls, M., Langhorst, J., Dobos, G., & Cramer, H. (2020). Perceived stress mediates the effect of yoga on quality of life and disease activity in ulcerative colitis. Secondary analysis of a randomized controlled trial. *Journal of Psychosomatic Research*, *130*, 109917. https://doi.org/10.1016/j.jpsychores.2019.109917

Krane, V. (1993). A Practical Application of the Anxiety–Athletic Performance Relationship: The Zone of Optimal Functioning Hypothesis. *The Sport Psychologist*, *7*(2), 113–126. https://doi.org/10.1123/tsp.7.2.113

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

Kupriyanov, R., & Zhdanov, R. (2014). The eustress concept: problems and outlooks. *World Journal of Medical Sciences*, *11*(2), 179–185. https://doi.org/10.5829/idosi.wjms.2014.11.2.8433

Kuyken, W., Byford, S., Taylor, R. S., Watkins, E., Holden, E., White, K., Barrett, B., Byng, R., Evans, A., Mullan, E., & Teasdale, J. D. (2008). Mindfulness-based cognitive therapy to prevent relapse in recurrent depression. *Journal of Consulting and Clinical Psychology*, *76*(6), 966–978. https://doi.org/10.1037/a0013786

Lacaille, J., Sadikaj, G., Nishioka, M., Carrière, K., Flanders, J., & Knäuper, B. (2017). Daily Mindful Responding Mediates the Effect of Meditation Practice on Stress and Mood: The Role of Practice Duration and Adherence. *Journal of Clinical Psychology*, *74*(1), 109–122. https://doi.org/10.1002/jclp.22489

Lazar, S. W., Kerr, C. E., Wasserman, R. H., Gray, J. R., Greve, D. N., Treadway, M. T., McGarvey, M., Quinn, B. T., Dusek, J. A., Benson, H., Rauch, S. L., Moore, C. I., & Fischl, B. (2005). Meditation experience is associated with increased cortical thickness. *NeuroReport*, *16*(17), 1893–1897. https://doi.org/10.1097/01.wnr.0000186598.66243.19

Lazarus, R. S. (1990). Theory-Based Stress Measurement. *Psychological Inquiry*, *1*(1), 3–13. https://doi.org/10.1207/s15327965pli0101_1

Lazarus, R. S., & Folkman, S. (1984). *Stress, Appraisal, and Coping* (1st ed.). Springer Publishing Company.

Le Moal, M. (2007). Historical approach and evolution of the stress concept: A personal account. *Psychoneuroendocrinology*, *32*, S3–S9. https://doi.org/10.1016/j.psyneuen.2007.03.019

Lee, E.-H. (2012). Review of the Psychometric Evidence of the Perceived Stress Scale. *Asian Nursing Research*, *6*(4), 121–127. https://doi.org/10.1016/j.anr.2012.08.004

Levin, M. E., Haeger, J., An, W., & Twohig, M. P. (2018). Comparing Cognitive Defusion and Cognitive Restructuring Delivered Through a Mobile App for Individuals High in Self-Criticism. *Cognitive Therapy and Research*, *42*(6), 844–855. https://doi.org/10.1007/s10608-018-9944-3

Levin, M. E., Haeger, J., Pierce, B., & Cruz, R. A. (2017). Evaluating an Adjunctive Mobile App to Enhance Psychological Flexibility in Acceptance and Commitment Therapy. *Behavior Modification*, *41*(6), 846–867. https://doi.org/10.1177/0145445517719661

Levin, M. E., Hildebrandt, M. J., Lillis, J., & Hayes, S. C. (2012). The Impact of Treatment Components Suggested by the Psychological Flexibility Model: A Meta-Analysis of Laboratory-Based Component Studies. *Behavior Therapy*, *43*(4), 741–756. https://doi.org/10.1016/j.beth.2012.05.003

Li, C. T., Cao, J., & Li, T. M. (2016, September). Eustress or distress: An empirical study of perceived stress in everyday college life. In *Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct* (pp. 1209-1217).

Li, C., Zhu, Y., Zhang, M., Gustafsson, H., & Chen, T. (2019). Mindfulness and Athlete Burnout: A Systematic Review and Meta-Analysis. *International Journal of Environmental Research and Public Health*, *16*(3), 449. https://doi.org/10.3390/ijerph16030449

Littlefair, S., Staff, M., & Salzbery, S. (2018, August 29). *Can Your Smartphone Make You Mindful?* Mindful. https://www.mindful.org/can-your-smartphone-make-you-mindful/

Lomas, T., Cartwright, T., Edginton, T., & Ridge, D. (2015). A Qualitative Analysis of Experiential Challenges Associated with Meditation Practice. *Mindfulness*, *6*(4), 848–860. https://doi.org/10.1007/s12671-014-0329-8

Lomas, T., Medina, J. C., Ivtzan, I., Rupprecht, S., & Eiroa-Orosa, F. J. (2018). Mindfulness-based interventions in the workplace: An inclusive systematic review and meta-analysis of their impact upon wellbeing. *The Journal of Positive Psychology*, *14*(5), 625–640. https://doi.org/10.1080/17439760.2018.1519588

Lorenz, D. S., Reiman, M. P., Lehecka, B. J., & Naylor, A. (2013). What Performance Characteristics Determine Elite Versus Nonelite Athletes in the Same Sport? *Sports Health: A Multidisciplinary Approach*, *5*(6), 542–547. https://doi.org/10.1177/1941738113479763

Lovallo, W. R. (2015). *Stress and Health: Biological and Psychological Interactions* (3rd ed.). SAGE Publications, Inc.

Luethi, M. (2009). Stress effects on working memory, explicit memory, and implicit memory for neutral and emotional stimuli in healthy men. *Frontiers in Behavioral Neuroscience*, *2*, 5. https://doi.org/10.3389/neuro.08.005.2008

Lumma, A.-L., Kok, B. E., & Singer, T. (2015). Corrigendum to "Is meditation always relaxing? Investigating heart rate, heart rate variability, experienced effort and likeability during training of three types of meditation" [Int. J. Psychophysiol. 97/1 (2015) 38–45]. *International Journal of Psychophysiology*, *117*, 126–130. https://doi.org/10.1016/j.ijpsycho.2017.02.014

Luoma, J. B., Kohlenberg, B. S., Hayes, S. C., Bunting, K., & Rye, A. K. (2008). Reducing self-stigma in substance abuse through acceptance and commitment therapy: Model, manual development, and pilot outcomes. *Addiction Research & Theory*, *16*(2), 149–165. https://doi.org/10.1080/16066350701850295

Lutz, A., Greischar, L. L., Perlman, D. M., & Davidson, R. J. (2009). BOLD signal in insula is differentially related to cardiac function during compassion meditation in experts vs. novices. *NeuroImage*, *47*(3), 1038–1046. https://doi.org/10.1016/j.neuroimage.2009.04.081

Ly, K. H., Dahl, J. A., Carlbring, P., & Andersson, G. (2012). Development and initial evaluation of a smartphone application based on acceptance and commitment therapy. *SpringerPlus*, *1*(1), 1–11. https://doi.org/10.1186/2193-1801-1-11

Ly, K. H., Trüschel, A., Jarl, L., Magnusson, S., Windahl, T., Johansson, R., Carlbring, P., & Andersson, G. (2014). Behavioural activation versus mindfulness-based guided self-help treatment administered through a smartphone application: a randomised controlled trial. *BMJ Open*, *4*(1), e003440. https://doi.org/10.1136/bmjopen-2013-003440

Lykins, E. L. B., & Baer, R. A. (2009). Psychological Functioning in a Sample of Long-Term Practitioners of Mindfulness Meditation. *Journal of Cognitive Psychotherapy*, *23*(3), 226–241. https://doi.org/10.1891/0889-8391.23.3.226

Lykins, E. L. B., Baer, R. A., & Gottlob, L. R. (2012). Performance-Based Tests of Attention and Memory in Long-Term Mindfulness Meditators and Demographically Matched Nonmeditators. *Cognitive Therapy and Research*, *36*(1), 103–114. https://doi.org/10.1007/s10608-010-9318-y

MacKillop, J., & Anderson, E. J. (2007). Further Psychometric Validation of the Mindful Attention Awareness Scale (MAAS). *Journal of Psychopathology and Behavioral Assessment*, *29*(4), 289–293. https://doi.org/10.1007/s10862-007-9045-1

Mahoney, J., & Hanrahan, S. J. (2011). A Brief Educational Intervention Using Acceptance and Commitment Therapy: Four Injured Athletes' Experiences. *Journal of Clinical Sport Psychology*, *5*(3), 252–273. https://doi.org/10.1123/jcsp.5.3.252

Main, L., & Grove, J. R. (2009). A multi-component assessment model for monitoring training distress among athletes. *European Journal of Sport Science*, *9*(4), 195–202. https://doi.org/10.1080/17461390902818260

Manuello, J., Vercelli, U., Nani, A., Costa, T., & Cauda, F. (2016). Mindfulness meditation and consciousness: An integrative neuroscientific perspective. *Consciousness and Cognition*, *40*, 67–78. https://doi.org/10.1016/j.concog.2015.12.005

Masters, R. S. W. (1992). Knowledge, knerves and know-how: The role of explicit versus implicit knowledge in the breakdown of a complex motor skill under pressure. *British Journal of Psychology*, *83*(3), 343–358. https://doi.org/10.1111/j.2044-8295.1992.tb02446.x

Masters, R. S. W., & Maxwell, J. P. (2008). The Theory of Reinvestment. *International Review of Sport and Exercise Psychology*, *1*(2), 160–183. https://doi.org/10.1080/17509840802287218

Masuda, A., & Tully, E. C. (2012). The Role of Mindfulness and Psychological Flexibility in Somatization, Depression, Anxiety, and General Psychological Distress in a Nonclinical College Sample. *Journal of Evidence-Based Complementary & Alternative Medicine*, *17*(1), 66–71. https://doi.org/10.1177/2156587211423400

Maydych, V. (2019). The Interplay Between Stress, Inflammation, and Emotional Attention: Relevance for Depression. *Frontiers in Neuroscience*, *13*, 384. https://doi.org/10.3389/fnins.2019.00384

Mehrsafar, A. H., Gazerani, P., Moghadam Zadeh, A., & Jaenes Sánchez, J. C. (2020). Addressing potential impact of COVID-19 pandemic on physical and mental health of

elite athletes. *Brain, Behavior, and Immunity*, *87*, 147–148. https://doi.org/10.1016/j.bbi.2020.05.011

Moen, F., Myhre, K., & Stiles, T. C. (2016). An exploration about how Passion, Perceived performance, Stress and Worries uniquely influence Athlete Burnout. *Journal of Physical Education and Sports Management*, *3*(1), 88–107. https://doi.org/10.15640/jpesm.v3n1a7

Mohammed, W. A., Pappous, A., & Sharma, D. (2018). Effect of Mindfulness Based Stress Reduction (MBSR) in Increasing Pain Tolerance and Improving the Mental Health of Injured Athletes. *Frontiers in Psychology*, *9*, 722. https://doi.org/10.3389/fpsyg.2018.00722

Moreno-Smith, M., Lutgendorf, S. K., & Sood, A. K. (2010). Impact of stress on cancer metastasis. *Future Oncology*, *6*(12), 1863–1881. https://doi.org/10.2217/fon.10.142

Morgan 3rd, C. A., Cho, T., Hazlett, G., Coric, V., & Morgan, J. (2002). The impact of burnout on human physiology and on operational performance: a prospective study of soldiers enrolled in the combat diver qualification course. *The Yale journal of biology and medicine*, *75*(4), 199.

Morris, E. M. J., Johns, L. C., & Oliver, J. E. (2013). *Acceptance and Commitment Therapy and Mindfulness for Psychosis* (1st ed.). Wiley-Blackwell.

Mosewich, A. D., Crocker, P. R. E., Kowalski, K. C., & DeLongis, A. (2013). Applying Self-Compassion in Sport: An Intervention With Women Athletes. *Journal of Sport and Exercise Psychology*, *35*(5), 514–524. https://doi.org/10.1123/jsep.35.5.514

Mosewich, A. D., Ferguson, L. J., McHugh, T.-L. F., & Kowalski, K. C. (2019). Enhancing capacity: Integrating self-compassion in sport. *Journal of Sport Psychology in Action*, *10*(4), 235–243. https://doi.org/10.1080/21520704.2018.1557774

Mosewich, A. D., Sabiston, C. M., Kowalski, K. C., Gaudreau, P., & Crocker, P. R. E. (2019). Self-Compassion in the Stress Process in Women Athletes. *The Sport Psychologist*, *33*(1), 23–34. https://doi.org/10.1123/tsp.2017-0094

Neff, K. (2003). Self-Compassion: An Alternative Conceptualization of a Healthy Attitude Toward Oneself. *Self and Identity*, *2*(2), 85–101. https://doi.org/10.1080/15298860309032

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

Norouzi, E., Gerber, M., Masrour, F. F., Vaezmosavi, M., Pühse, U., & Brand, S. (2020). Implementation of a mindfulness-based stress reduction (MBSR) program to reduce stress, anxiety, and depression and to improve psychological well-being among retired Iranian football players. *Psychology of Sport and Exercise*, *47*, 101636. https://doi.org/10.1016/j.psychsport.2019.101636

Nyklíček, I., & Irrmischer, M. (2017). For Whom Does Mindfulness-Based Stress Reduction Work? Moderating Effects of Personality. *Mindfulness*, *8*(4), 1106–1116. https://doi.org/10.1007/s12671-017-0687-0

O'Connor, K. M., Arnold, J. A., & Maurizio, A. M. (2010). The prospect of negotiating: Stress, cognitive appraisal, and performance. *Journal of Experimental Social Psychology*, *46*(5), 729–735. https://doi.org/10.1016/j.jesp.2010.04.007

Olive, M. L., & Smith, B. W. (2005). Effect size calculations and single subject designs. *Educational Psychology*, *25*(2–3), 313–324. https://doi.org/10.1080/0144341042000301238

O'Neill, M., Allen, B., & Calder, A. M. (2013). Pressures to perform: An interview study of Australian high performance school-age athletes' perceptions of balancing their school and sporting lives. *Performance Enhancement & Health*, *2*(3), 87–93. https://doi.org/10.1016/j.peh.2013.06.001

Orme-Johnson, D. W., & Barnes, V. A. (2014). Effects of the Transcendental Meditation Technique on Trait Anxiety: A Meta-Analysis of Randomized Controlled Trials. *The Journal of Alternative and Complementary Medicine*, *20*(5), 330–341. https://doi.org/10.1089/acm.2013.0204

Orzech, K. M., Shapiro, S. L., Brown, K. W., & McKay, M. (2009). Intensive mindfulness training-related changes in cognitive and emotional experience. *The Journal of Positive Psychology*, *4*(3), 212–222. https://doi.org/10.1080/17439760902819394

O'Sullivan, G. (2011). The Relationship Between Hope, Eustress, Self-Efficacy, and Life Satisfaction Among Undergraduates. *Social Indicators Research*, *101*(1), 155–172. https://doi.org/10.1007/s11205-010-9662-z

Palmer, C. (2002). 'Shit Happens': The Selling of Risk in Extreme Sport. *The Australian Journal of Anthropology*, *13*(3), 323–336. https://doi.org/10.1111/j.1835-9310.2002.tb00213.x

Paredes, D., & Morilak, D. A. (2019). A Rodent Model of Exposure Therapy: The Use of Fear Extinction as a Therapeutic Intervention for PTSD. *Frontiers in Behavioral Neuroscience*, *13*, 46. https://doi.org/10.3389/fnbeh.2019.00046

Park, C. L., Armeli, S., & Tennen, H. (2004). The daily stress and coping process and alcohol use among college students. *Journal of Studies on Alcohol*, *65*(1), 126–135. https://doi.org/10.15288/jsa.2004.65.126

Park, J. M. A. (2020). *A literature review and meta-analysis of mindfulness in schools*. Graduate School of The Ohio State University. https://etd.ohiolink.edu/apexprod/rws_etd/send_file/send?accession=osu1586087836534212&disposition=inline

Peifer, C., Schulz, A., Schächinger, H., Baumann, N., & Antoni, C. H. (2014). The relation of flow-experience and physiological arousal under stress — Can u shape it? *Journal of Experimental Social Psychology*, *53*, 62–69. https://doi.org/10.1016/j.jesp.2014.01.009

Perich, T., Manicavasagar, V., Mitchell, P. B., & Ball, J. R. (2013). The association between meditation practice and treatment outcome in Mindfulness-based Cognitive Therapy for bipolar disorder. *Behaviour Research and Therapy*, *51*(7), 338–343. https://doi.org/10.1016/j.brat.2013.03.006

PhD, J. L. B., PhD, S. H. C., & PhD, R. W. D. (2017). *Learning ACT: An Acceptance and Commitment Therapy Skills Training Manual for Therapists* (Second Edition, Revised ed.). Context Press.

Porcelli, A. J., Cruz, D., Wenberg, K., Patterson, M. D., Biswal, B. B., & Rypma, B. (2008). The effects of acute stress on human prefrontal working memory systems. *Physiology & Behavior*, *95*(3), 282–289. https://doi.org/10.1016/j.physbeh.2008.04.027

Raanes, E. F. W., Hrozanova, M., & Moen, F. (2019). Identifying Unique Contributions of the Coach–Athlete Working Alliance, Psychological Resilience and Perceived Stress on Athlete Burnout among Norwegian Junior Athletes. *Sports*, *7*(9), 212. https://doi.org/10.3390/sports7090212

Raedeke, T. D., & Smith, A. L. (2004). Coping Resources and Athlete Burnout: An Examination of Stress Mediated and Moderation Hypotheses. *Journal of Sport and Exercise Psychology*, *26*(4), 525–541. https://doi.org/10.1123/jsep.26.4.525

Raes, F., Pommier, E., Neff, K. D., & Van Gucht, D. (2011). Construction and Factorial Validation of a Short Form of the Self-Compassion Scale. *Clinical Psychology & Psychotherapy*, *18*(3), 250–255. https://doi.org/10.1002/cpp.702

Rapolienė, L., Razbadauskas, A., & Jurgelėnas, A. (2015). The Reduction of Distress Using Therapeutic Geothermal Water Procedures in a Randomized Controlled Clinical Trial. *Advances in Preventive Medicine*, *2015*, 1–10. https://doi.org/10.1155/2015/749417

Rathbone, A. L., & Prescott, J. (2017). The Use of Mobile Apps and SMS Messaging as Physical and Mental Health Interventions: Systematic Review. *Journal of Medical Internet Research*, *19*(8), 295. https://doi.org/10.1176/appi.focus.16406

Renn, B. N., Hoeft, T. J., Lee, H. S., Bauer, A. M., & Areán, P. A. (2019). Preference for in-person psychotherapy versus digital psychotherapy options for depression: survey of

adults in the U.S. *Npj Digital Medicine*, *2*(1), 1–7. https://doi.org/10.1038/s41746-019-0077-1

Ribeiro, L., Atchley, R. M., & Oken, B. S. (2018). Adherence to Practice of Mindfulness in Novice Meditators: Practices Chosen, Amount of Time Practiced, and Long-Term Effects Following a Mindfulness-Based Intervention. *Mindfulness*, *9*(2), 401–411. https://doi.org/10.1007/s12671-017-0781-3

Rice, S. M., Purcell, R., De Silva, S., Mawren, D., McGorry, P. D., & Parker, A. G. (2016). The Mental Health of Elite Athletes: A Narrative Systematic Review. *Sports Medicine*, *46*(9), 1333–1353. https://doi.org/10.1007/s40279-016-0492-2

Riskin, L. L. (2002). The contemplative lawyer: On the potential contributions of mindfulness meditation to law students, lawyers, and their clients. *Harv. Negot. L. Rev.*, *7*, 1.

Roemer, L., & Orsillo, S. M. (2002). Expanding Our Conceptualization of and Treatment for Generalized Anxiety Disorder: Integrating Mindfulness/Acceptance-Based Approaches With Existing Cognitive-Behavioral Models. *Clinical Psychology: Science and Practice*, *9*(1), 54–68. https://doi.org/10.1093/clipsy.9.1.54

Rolffs, J. L., Rogge, R. D., & Wilson, K. G. (2018). Disentangling Components of Flexibility via the Hexaflex Model: Development and Validation of the Multidimensional Psychological Flexibility Inventory (MPFI). *Assessment*, *25*(4), 458–482. https://doi.org/10.1177/1073191116645905

Rosa, E. F., Takahashi, S., Aboulafia, J., Nouailhetas, V. L. A., & Oliveira, M. G. M. (2007). Oxidative Stress Induced by Intense and Exhaustive Exercise Impairs Murine

Cognitive Function. *Journal of Neurophysiology*, *98*(3), 1820–1826. https://doi.org/10.1152/jn.01158.2006

Rumbold, J. L., Fletcher, D., & Daniels, K. (2012). A systematic review of stress management interventions with sport performers. *Sport, Exercise, and Performance Psychology*, *1*(3), 173–193. https://doi.org/10.1037/a0026628

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/0003-066x.55.1.68

Saint Arnault, D. (2009). Cultural Determinants of Help Seeking: A Model for Research and Practice. *Research and Theory for Nursing Practice*, *23*(4), 259–278. https://doi.org/10.1891/1541-6577.23.4.259

Schenström, A., Rönnberg, S., & Bodlund, O. (2006). Mindfulness-Based Cognitive Attitude Training for Primary Care Staff: A Pilot Study. *Complementary Health Practice Review*, *11*(3), 144–152. https://doi.org/10.1177/1533210106297033

Schoenefeld, S. J., & Webb, J. B. (2013). Self-compassion and intuitive eating in college women: Examining the contributions of distress tolerance and body image acceptance and action. *Eating Behaviors*, *14*(4), 493–496. https://doi.org/10.1016/j.eatbeh.2013.09.001

Schwabach, J., Bartley, J., & Polk, K. (2019). Sorting it out: a framework for increasing mental flexibility and valued action in athletes using the ACT matrix. *Journal of Sport Psychology in Action*, *10*(4), 208–213. https://doi.org/10.1080/21520704.2018.1549638

Schwanhausser, L. (2009). Application of the Mindfulness-Acceptance-Commitment (MAC) Protocol With an Adolescent Springboard Diver. *Journal of Clinical Sport Psychology*, *3*(4), 377–395. https://doi.org/10.1123/jcsp.3.4.377

Scott-Hamilton, J., & Schutte, N. S. (2016). The Role of Adherence in the Effects of a Mindfulness Intervention for Competitive Athletes: Changes in Mindfulness, Flow, Pessimism, and Anxiety. *Journal of Clinical Sport Psychology*, *10*(2), 99–117. https://doi.org/10.1123/jcsp.2015-0020

Scott-Hamilton, J., Schutte, N. S., & Brown, R. F. (2016). Effects of a Mindfulness Intervention on Sports-Anxiety, Pessimism, and Flow in Competitive Cyclists. *Applied Psychology: Health and Well-Being*, *8*(1), 85–103. https://doi.org/10.1111/aphw.12063

Scruggs, T. E., & Mastropieri, M. A. (1998). Summarizing Single-Subject Research. *Behavior Modification*, *22*(3), 221–242. https://doi.org/10.1177/01454455980223001

Scruggs, T. E., Mastropieri, M. A., & Casto, G. (1987). The Quantitative Synthesis of Single-Subject Research: Methodology and Validation. *Remedial and Special Education*, *8*(2), 24–33. https://doi.org/10.1177/074193258700800206

Sedlmeier, P., Eberth, J., Schwarz, M., Zimmermann, D., Haarig, F., Jaeger, S., & Kunze, S. (2012). The psychological effects of meditation: A meta-analysis. *Psychological Bulletin*, *138*(6), 1139–1171. https://doi.org/10.1037/a0028168

Segal, Z. V., Williams, M., & Teasdale, J. (2013). *Mindfulness-based cognitive therapy for depression*. (2nd ed.). The Guilford Press. https://www.google.co.nz/books/edition/Mindfulness_Based_Cognitive_Therapy_for/

QHRVDwAAQBAJ?hl=en&gbpv=1&dq=Mindfulness-Based+Cognitive+Therapy+for+Depression,+Second+Edition&pg=PP1&printsec=frontcover

Shapiro, S. L., Brown, K. W., Thoresen, C., & Plante, T. G. (2011). The Moderation of Mindfulness-Based Stress Reduction Effects by Trait Mindfulness: Results from a Randomized Controlled Trial. *Journal of Clinical Psychology*, *67*(3), 267–277. https://doi.org/10.1002/jclp.20761

Shapiro, S. L., Oman, D., Thoresen, C. E., Plante, T. G., & Flinders, T. (2008). Cultivating mindfulness: effects on well-being. *Journal of Clinical Psychology*, *64*(7), 840–862. https://doi.org/10.1002/jclp.20491

Silverman, M. N., & Sternberg, E. M. (2012). Glucocorticoid regulation of inflammation and its functional correlates: from HPA axis to glucocorticoid receptor dysfunction. *Annals of the New York Academy of Sciences*, *1261*(1), 55–63. https://doi.org/10.1111/j.1749-6632.2012.06633.x

Singh, Y., & Sharma, R. (2012). Relationship between general intelligence, emotional intelligence, stress levels and stress reactivity. *Annals of Neurosciences*, 107–111. https://doi.org/10.5214/ans.0972.7531.190304

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

Smith, R. E. (1986). Toward a Cognitive-Affective Model of Athletic Burnout. *Journal of Sport Psychology*, *8*(1), 36–50. https://doi.org/10.1123/jsp.8.1.36

Spacapan, S., & Oskamp, S. (1988). *The Social Psychology of Health*. Sage Publications.

Taren, A. A., Creswell, J. D., & Gianaros, P. J. (2013). Dispositional Mindfulness Co-Varies with Smaller Amygdala and Caudate Volumes in Community Adults. *PLoS ONE*, *8*(5), e64574. https://doi.org/10.1371/journal.pone.0064574

Titze, C., Fett, D., Trompeter, K., Platen, P., Gajsar, H., & Hasenbring, M. I. (2021). Psychosocial subgroups in high-performance athletes with low back pain: eustress-endurance is most frequent, distress-endurance most problematic! *Scandinavian Journal of Pain*, *21*(1), 59–69. https://doi.org/10.1515/sjpain-2020-0053

Tsetsi, E., & Rains, S. A. (2017). Smartphone Internet access and use: Extending the digital divide and usage gap. *Mobile Media & Communication*, *5*(3), 239–255. https://doi.org/10.1177/2050157917708329

Wendling, H. M. (2012, May). *The relation between psychological flexibility and the Buddhist practices of meditation, nonattachment, and self-compassion*. The Graduate Faculty of The University of Akron. https://etd.ohiolink.edu/apexprod/rws_etd/send_file/send?accession=akron1332773514&disposition=inline

Wilson, C. J., Holmes, Y. B., & Holmes, D. B. (2014). The Effect of Emotion Regulation Strategies on Physiological and Self-report Measures of Anxiety During a Stress-inducing Academic Task. *International Journal of Psychology and Psychological Therapy*, *14*(1), 1–15. https://www.redalyc.org/pdf/560/56031292001.pdf

Wilson, G., & Pritchard, M. (2005). Comparing Sources of Stress in College Student Athletes and Non-Athletes. *Athletic Insight The Online Journal of Sports Psychology*, *7*(1), 1–8. http://amyburris.atspace.com/StressPDF.pdf

Zakrajsek, R. A., & Blanton, J. E. (2017). Evaluation of Psychological Interventions in Sport and Exercise Settings. *Oxford Research Encyclopedia of Psychology*, 1–25. https://doi.org/10.1093/acrefore/9780190236557.013.223

Chapter Eight Appendices

Appendix A: Participant Information Sheet

Can Mindfulness Help High Performance Athletes?

INFORMATION FOR PARTICIPANTS

Thank you for showing an interest in this study. Please read everything below before deciding if you want to take part. This information sheet will tell you a little more about the study, and what we would like you to do.

This research will be investigating the effects of mindfulness psychoeducation and meditation practice with high performance athletes. This study is been conducted by Taylor Rapley, Masters Student at Massey University, School of Psychology. During the study Taylor will be supervised by Dr Ian de Terte, senior lecturer and clinical psychologist within the School of Psychology at Massey University.

Project Description

The purpose of this thesis is to investigate the effects of mindfulness psychoeducation and meditation on high performance athletes and the benefits to athletes dealing with stress. During this research project I will assess how mindfulness meditation paired with psychoeducation may affect athletes' perceived stress, dispositional mindfulness (mindfulness as a habit), psychological inflexibility and self-compassion over time.

Why is this research important?

The difference between winning and losing is largely influenced by athletes' ability to successfully perform under varying stressors. For this reason, athletes are continually seeking to develop skills in order to be able to cope with extensive pressure, yet simultaneously perform to an exceptionally high standard.

Mindfulness Based Interventions are gaining momentum in the domain of sport and performance psychology to help athletes better deal with stress. Mindfulness Base Interventions focus on skills which allow individuals to better deal with challenging experiences through changing the way one relates to such experiences. In doing so, individuals come to recognise that stress is inevitable but distress is not, and so become better equipped to deal with stress without it becoming detrimental to their wellbeing and performance.

There is evidence to suggest that Mindfulness Based Interventions can reduce perceived stress and psychological inflexibility, and increase dispositional mindfulness and self-compassion. There is also evidence to suggest that Mindfulness Based Interventions could be an alternative, more successful intervention with athletes in comparison to more traditional psychological skills training.

Who can take part in this study?

Inclusion to participate in this study will be based on a number of factors; 1) participants must be competitive athletes competing at a national and/or international level, 2) participants must be older than 18 years old, 3) participants must have no personal relationship with the primary researcher, and 4) participants' level of perceived stress. Based on the above criteria, at least three participants will be selected to participate in the study at the discretion of the researcher.

How do I volunteer to participate in this study?

To volunteer to participate in this study you will be required to fill out a demographic questionnaire which will include the email, gender, age, location, sport and duration of current sporting status, as well as previous mindfulness experience. In addition, you will complete a Perceived Stress questionnaire (PSS-10). Overall, this should take you

approximately 5 - 10 minutes. Once completed, the demographic question and perceived stress scale will be returned to the primary researcher via email.

What will I be asked to do if I am selected for the study?

Participants selected for the study will be contacted directly by the primary researcher to personally thank them and answer any questions and inform them of procedures moving forward.

Baseline Testing

Selected participants will complete four surveys, once a week for at least 3 weeks. Each survey should take approximately 5 minutes to complete.

The Intervention

After 3 weeks of baseline testing, participants will watch a 25-minute mindfulness psychoeducation pre-recorded video; this will be facilitated by the principal researcher. This session will introduce the mindfulness app and educate the participants on the science and mechanisms of mindfulness and meditation, as well as specific benefits related to individual well-being and performance outcomes.

Once participants have watched the psychoeducation session, they will begin using the smartphone meditation application. Participants will spend 12 days learning meditation, followed by 30 days practicing mindfulness meditation as part of the 30-Day Challenge. During the recording, participants will be given the option to complete the 12 days of learning in three hours over one day. It is important that participants **do not** choose this option. The learning must be completed over 12 days, with one lesson a day. Participants will use the app for a total of 42 days where they will be encouraged to meditate once a day for 30 days.

Mid Study Testing

Participants will be required to complete the same four surveys completed at the beginning of the study at two points during the mindfulness intervention. These surveys will be completed

once on day 14 of the meditation intervention and once on day 28. Each survey should take approximately five minutes to complete.

End of the Study

Once participants have completed the 30 day challenge, they will be required to complete four surveys, once a week for at least three weeks. These will be the same surveys that were completed at the beginning of the study. Each survey should take approximately five minutes to complete.

What are the benefits and risks of taking part in this study?

By identifying the effects of mindfulness psychoeducation and meditation on athletes' perceived stress, the proposed research will benefit individuals by assisting them to perform to their potential under high pressure situations in both sport and day-to-day life. If the hypotheses of this study areccorrect, participants should see a decrease in their perceived stress and psychological inflexibility, as well as an increase in dispositional mindfulness and self-compassion.

What will happen to information collected during the study?

Data gathered will be password protected and stored securely on the primary researcher's computer and only accessed by the primary researcher and research supervisor. Data will be protected and retained for five years as per the Massey University guidelines, after which data will be disposed of. Publications in academic journals may result from this thesis.

Participants will be able to access a summary of the project findings on the completion of the project upon request. To ensure participant confidentiality, participant names and any other identifiable information will not be included in the thesis or any published papers resulting from this research.

Participants Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study at any time;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded.

In relation to online assessments,

• completion and return of the questionnaire(s) implies consent. You have the right to decline to answer any particular question.

Project Contacts

Please do not hesitate to contact the researcher and/or supervisor for any questions related to the research project.

Principal Researcher

Taylor Rapley

Email: [redacted]

Phone: [redacted]

Researcher Supervisor

Doctor Ian de Terte

Email: I.deTerte@massey.ac.nz

Phone: +64 (04) 801 5799 ext. 63603

Compulsory Statements

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not be reviewed by one of the University's Human Ethics Committees. The researchers named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Prof Craig Johnson, Director of Research Ethics:

Phone: 06 356 9099 x 85271

Email: humanethics@massey.ac.nz.

Thank you for considering to participate in this study.

Appendix B: Personal Invitation Letter

MASSEY UNIVERSITY
COLLEGE OF HUMANITIES
AND SOCIAL SCIENCES
TE KURA PŪKENGA TANGATA

8 July 2020

Dear High Performance Athlete

I am currently a Psychology Masters student at Massey University. As part of my research, I will be examining the effects of a Mindfulness Based Intervention using psychoeducation and meditation on athlete's perceived stress, as well as psychological inflexibility, dispositional mindfulness (mindfulness as a habit) and self-compassion, and I invite you to participate.

The difference between winning and losing is largely influenced by athletes' ability to successfully perform under varying stressors. For this reason, athletes are continuously seeking to develop skills to be able to cope with extensive pressure, yet simultaneously perform to an exceptionally high standard.

Mindfulness Based Interventions are gaining momentum in the domain of sport and performance psychology to help athletes better deal with stress. Mindfulness Based Interventions focus on skills that allow the individual to better deal with negative or challenging experiences through changing the way one relates to such experiences. In doing so, individuals come to recognise that stress is inevitable while distress is not, and become better equipped to deal with stress without it becoming detrimental to one's wellbeing and performance.

There is evidence to suggest that Mindfulness Based Interventions can reduce perceived stress, and psychological inflexibility, as well as increase self-compassion and dispositional mindfulness. There is also evidence to suggest that mindfulness-based interventions could be an alternative, more successful intervention with athletes in comparison to traditional psychological skills training. An information sheet outlining all procedures and that participation is voluntary and confidential is enclosed.

We ask that you read the information sheet and if you have any questions about the study or require further information please contact me or my supervisor, Dr Ian de Terte. My direct line is [redacted] or alternatively, my email is [redacted]. Dr Ian de Terte's direct line is +64 (04) 801 5799 ext. 63603 or his email address is I.deterte@massey.ac.nz.

Yours sincerely,

Taylor Rapley
Primary Researcher
School of Psychology, Massey University.

Appendix C: Participant Consent Form

Can Mindfulness Help Athletes?

PARTICIPANTS CONSENT FORM - INDIVIDUAL

I have read, or have had read to me in my first language, and I understand the Information Sheet attached. I have had the details of the study explained to me, any questions I have had been answered to my satisfaction, and I understand that I may ask further questions at any time. I have been given sufficient time to consider whether to participate in this study and I understand participation is voluntary and that I may withdraw from the study at any time.

1. I wish / do not wish to have data placed in an official archive.
2. I agree to participate in this study under the conditions set out in the information sheet.

Declaration by Participant

I _____ [print full name] _____ hereby consent to take part in this

study.

Signature: _____ Date: _____

Appendix D: Letter of Notification Human Ethics

Date: 22 April 2020

Dear Taylor Rapley

Re: Ethics Notification - 4000022511 - Is Mindfulness Helpful to Athletes?

Thank you for your notification which you have assessed as Low Risk.

Your project has been recorded in our system which is reported in the Annual Report of the Massey University Human Ethics Committee.

The low risk notification for this project is valid for a maximum of three years.

If situations subsequently occur which cause you to reconsider your ethical analysis, please contact a Research Ethics Administrator.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Professor Craig Johnson, Director - Ethics, telephone 06 3569099 ext 85271, email humanethics@massey.ac.nz."

Please note, if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to complete the application form again, answering "yes" to the publication question to provide more information for one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Professor Craig Johnson
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 350 5573; 06 350 5575 F 06 355 7973 E humanethics@massey.ac.nz W http://humanethics.massey.ac.nz

Appendix E: Demographic Questionnaire

Can Mindfulness Help Athletes?

Demographic Questionnaire

Please answer the following questions before completing the Perceived Stress Scale assessment. Completion and return of the questionnaire(s) implies consent. You have the right to decline to answer any particular question. To ensure confidentiality, any identifiable information such as your name, will not be shared or published.

Once completed, please email the questionnaire and Perceived Stress assessment to [redacted].

Thank you for your time.

1. Full name:

2. Age:

3. Gender (please circle or highlight):

Male

Female

Other (please state):

4. Type of sport:

5. Are you a member of a New Zealand Team or New Zealand Development Team? Please circle or highlight.

Yes

No

6. In your sport, at what level do you compete? Please circle or highlight.

National level

International level

National & International level

Professional (paid)

7. How long have you been competing at this level? Please circle or highlight.

1 - 6 months

6 - 12 months

1 - 2 years

2 - 3 years

3+ years

8. Please circle or highlight the following in response to your experience of meditation:

I currently practice meditation.

I have practiced meditation in the past.

I have never practiced meditation.

9. Do you have a personal relationship with the principal researcher, Taylor Rapley? Please circle or highlight.

Yes

No

Please answer the 10 multiple choice Perceived Stress Scale assessment questions to the best of your ability. This should take approximately 5 - 10 minutes.

Once completed, please return your demographic questionnaire and Perceived Stress Scale assessment to [redacted].

Thank you kindly.

Appendix F: Perceived Stress Scale (PSS-10)

The Perceived Stress Scale (PSS-10)

The questions this scale (Cohen, Kamarck & Mermelstein, 1983) ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

Name _____ Date _____ Age _____

Gender (*Circle*): **M F** Other _____

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?

0 1 2 3 4

2. In the last month, how often have you felt that you were unable to control the important things in your life?

0 1 2 3 4

3. In the last month, how often have you felt nervous and "stressed"?

0 1 2 3 4

4. In the last month, how often have you felt confident about your ability to handle your personal problems?

0 1 2 3 4

5. In the last month, how often have you felt that things were going your way?

0 1 2 3 4

6. In the last month, how often have you found that you could not cope with all the things that you had to do?

0 1 2 3 4

7. In the last month, how often have you been able to control irritations in your life?

0 1 2 3 4

8. In the last month, how often have you felt that you were on top of things?

0 1 2 3 4

9. In the last month, how often have you been angered because of things that were outside of your control?

0 1 2 3 4

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

0 1 2 3 4

Appendix G: Mindfulness Attention Awareness Scale (MAAS)

The Mindful Attention Awareness Scale (MAAS)

The trait MAAS (Brown & Ryan, 2003) is a 15-item scale designed to assess a core characteristic of mindfulness, namely, a receptive state of mind in which attention, informed by a sensitive awareness of what is occurring in the present, simply observes what is taking place.

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item.

Almost never Almost always

1 2 3 4 5

_____ 1. I could be experiencing some emotion and not be conscious of it until sometime later.

_____ 2. I break or spill things because of carelessness, not paying attention, or thinking of something else.

_____ 3. I find it difficult to stay focused on what's happening in the present.

_____ 4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.

_____ 5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.

_____ 6. I forget a person's name almost as soon as I've been told it for the first time.

_____ 7. It seems I am “running on automatic,” without much awareness of what I’m doing.

_____ 8. I rush through activities without being really attentive to them.

_____ 9. I get so focused on the goal I want to achieve that I lose touch with what I’m doing right now to get there.

_____ 10. I do jobs or tasks automatically, without being aware of what I'm doing.

_____ 11. I find myself listening to someone with one ear, doing something else at the same time.

_____ 12. I drive places on ‘automatic pilot’ and then wonder why I went there.

_____ 13. I find myself preoccupied with the future or the past.

_____ 14. I find myself doing things without paying attention.

_____ 15. I snack without being aware that I’m eating.

Appendix H: Acceptance & Action Questionnaire (AAQ-II)

AAQ-II

Below you will find a list of statements. Please rate how true each statement is for you by using the scale below to fill in your choice.

1	**2**	**3**	**4**	**5**	**6**	**7**
never true	**very seldom true**	**seldom true**	**sometimes true**	**frequently true**	**almost always true**	**always true**

1. My painful experiences and memories make it difficult for me to live a life that I would value.

2. I'm afraid of my feelings.

3. I worry about not being able to control my feelings or worries.

4. My painful memories prevent me from having a fulfilling life.

5. Emotions cause problems in my life.

6. It seems like most people are handling their lives better than I am.

7. Worries get in the way of my success.

This is a one-factor measure of psychological inflexibility, or experiential avoidance. Score the scale by summing the seven items. Higher scores equal greater levels of psychological inflexibility.

Appendix I: Self-Compassion Scale (SCS-SF)

SELF-COMPASSION SCALE–Short Form (SCS–SF) 2

HOW I TYPICALLY ACT TOWARDS MYSELF IN DIFFICULT TIMES

Please read each statement carefully before answering (Raes, Pommier, Van Gucht, 2011). To the left of each item, indicate how often you behave in the stated manner, using the following scale:

Almost never Almost always

1 2 3 4 5

_____1. When I fail at something important to me, I become consumed by feelings of inadequacy.

_____2. I try to be understanding and patient towards those aspects of my personality I don't like.

_____3. When something painful happens, I try to take a balanced view of the situation.

_____4. When I'm feeling down, I tend to feel like most other people are probably happier than I am.

_____5. I try to see my failings as part of the human condition.

_____6. When I'm going through a very hard time, I give myself the caring and tenderness I need.

_____7. When something upsets me, I try to keep my emotions in balance.

_____8. When I fail at something that's important to me, I tend to feel alone in my failure.

_____9. When I'm feeling down, I tend to obsess and fixate on everything that's wrong.

_____10. When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people.

_____11. I'm disapproving and judgmental about my own flaws and inadequacies.

_____12. I'm intolerant and impatient towards those aspects of my personality I don't like.

Appendix J: Psychoeducation Video Transcript

Psychoeducation Session Outline

This psychoeducation session is aligned to module one of Gardner and Moore's (2007) Mindfulness Acceptance Commitment (MAC) approach for Human Performance. The information provided in this psychoeducation session is evidence-based. The aim of this session is to educate participants on mindfulness, processes of mindfulness, and how mindfulness can benefit high-performance athletes.

Psychoeducation for this study will cover:

- Information about theoretical and practical aspects of the mindfulness meditation intervention.
- Theoretical underpinnings of mindfulness.
- Personal benefits associated with formal mindfulness practice.
- An introduction to the structure of the meditation intervention.

Explaining Mindfulness and Meditation

- Mindfulness is a process characterised by paying attention to the present moment whilst maintaining a nonjudgmental attitude.
- Mindfulness-Based Interventions seek to alter the way a person relates to their own thoughts and/or emotions about a situation, as opposed to changing the content of their thoughts and emotions.
- Humans have a natural tendency to suppress and control negative thoughts and emotions, making them more likely to surface.
- Mindfulness teaches a person to become aware of and more accepting of discomfort. This can be helpful when managing negative thoughts and emotions in a person's sporting and personal life.
- Opposite of accepting discomfort may include deliberate attempts to suppress negative thoughts and emotions when a person is feeling distressed. To overcome this, with the idea that stress is bad, the person may force themself not to be stressed. This

type of thought control can heighten the person's experience of distress, impacting negatively on performance and well-being.

- Can you relate to a similar experience where your attempt to control your thoughts and emotions may have made them worse or the same, but not better?
- Mindfulness can increase awareness of unwanted thoughts and feelings with a non-judgemental, judgmental,accepting attitude.

What is nonjudgmental awareness?

- Non-judgmental awareness is the ability to accept the present moment and any unwanted thoughts, emotions, and sensations without labelling them as good, bad, wrong, or right.
- In other words, nonjudgemental awareness is letting go of the meaning of feelings and instead, and experiencing them for what they are - irrespective of what thoughts you might associate with them.
- A nonjudgmental attitude is generally associated with two key processes known as acceptance and defusion.

What does Acceptance mean?

- Acceptance is the process of accepting feelings, thoughts, and other sensations as an inevitable part of the human experience. This requires a willingness to experience internal events without defence.
- When associated with athletic performance, it is not the emotions or thoughts which have an influence – rather the approach a person takes to try and eliminate and/or control those emotions and thoughts.
- For example, have you ever felt overly distressed before an event, found yourself over-thinking your performance during an event, or feeling negative and lacking confidence? How successful have you been in consistently eliminating those negative thoughts and emotions?

- Trying to eliminate thoughts and feelings with an internal dialogue of "do not be anxious", "stop overthinking" or suppressive imagery can equally increase the occurrence and intensity of such thoughts and emotions.
- It is not always possible to eliminate negative thoughts and feelings.
- The alternative approach is to change how you relate to your thoughts and feelings.
- Think of an athlete you look up to. Do you wonder if they experience negative thoughts and feelings during or before moments where they are expected to perform?
- Often, these athletes can perform well despite difficult internal experiences. They do this not by over-interpreting the personal meaning or ramifications of specific negative experiences but by accepting short-term discomfort in the pursuit of personal goals and values. You may recognise this during situations you have performed well despite difficult feelings, thoughts, and other discomforts.
- Mindfulness can help a person manage these difficult experiences through experiential acceptance, thus preventing them from interfering with a person's behaviour, performance, and well-being.
- Experiential acceptance is the willingness to experience internal events without defence.
- Acceptance is associated with cognitive defusion.

What is Cognitive Defusion?

- Cognitive defusion is the ability to create a distance between the content or absolute meaning of thoughts and the relationship or believability of those thoughts.
- Imagine if every thought you ever had was a reflection of the absolute truth.
- A person's thoughts do not always reflect absolute reality, nor do they always require action.
- The concept of defusion can be understood by imagining you are the sky and your thoughts and emotions are clouds passing by. Like your thoughts and emotions, clouds are inevitable and impermanent, meaning they will come and go whether you like it or not.
- The sky does not fuse or attach to the clouds - even in the greatest storm, blue sky will still exist beneath the front. The blue sky observes the clouds from a distance,

allowing the clouds to come and go, without becoming part of the clouds. Like the blue sky, you can observe your thoughts and emotions from a distance, also allowing them to come and go, without becoming your thoughts and emotions

- *[illustration of moving weather in the sky to demonstrate metaphor].*
- By applying mindfulness, nonjudgemental awareness of thoughts becomes possible through a process of accepting them, isolating them from reality and drawing attention back to the present moment.
- The opposite of defusion is cognitive fusion. Fusion can be understood as having negative thoughts and emotions, which I will refer to as 'noise', and attaching to or identifying with that noise as absolute truth or something that needs to be controlled.
- In contrast, defusion occurs when a person dismisses the noise through a process in which it is simply allowed to exist, without the need to act on or control such noise.
- Whilst it is not always possible to stop 'noise', it can be defused through simple observation, and by choosing to behave in a way that is aligned with core values, rather than feelings or on-going negative thoughts.
- Defusion is about creating space between yourself and the noise. Within that space, you have the freedom to choose how you want to respond to that discomfort based on what will best serve you in that moment, rather than letting your emotions drive your behaviour.
- Defusion can also help you to accept difficult emotions and thoughts as an inevitable part of high-performance sport, without the need to control or suppress them because controlling internal 'noise' is not always possible, especially during high-pressure situations.
- Mindfulness works by fostering greater nonjudgemental awareness, experiential acceptance, and cognitive defusion in every-day life.

What happens when you try to control the noise instead of accepting it with a non-judgmental attitude?

- The assumption that discomfort is bad and the resultant efforts to minimise discomfort through avoidance or 'thought-control' can make unwanted experiences worse.

- The failure to accept and defuse from 'noise' can result in a shift from feeling temporary discomfort to unnecessary suffering. This can cause heightened negative thoughts and emotions, resulting in rumination (worrying about the past), speculation (anticipating the future), and task-irrelevant attention – leading to poor performance and diminished well-being.
- Mindfulness is the process by which a person learns to observe and accept a variety of naturally occurring thoughts and emotions that are constantly changing, and not always necessary to control.
- When a person practices mindfulness, they are practicing nonjudgmental awareness of the present moment.
- Non-judgmental awareness of present thoughts and feelings can allow a person to accept and defuse from negative thoughts and emotions. In the context of performance, this can be likened shifting from a place of "I want to perform well **but** I am thinking negatively or feeling badly," to "I want to perform well **and** I am thinking negatively or feeling bad." Notice how within the first instance, the initial segment does not allow the second segment to coexist, while the second instance allows room for both segments to happen simultaneously.
- The mindful athlete can perform, irrespective of what thoughts and emotions may arise.

How can mindfulness help you?

- Mindfulness replaces the concept of needing to think and feel good in order to perform optimally with the concept of being able to feel or think negatively whilst being able to achieve optimal performance.
- Mindfulness is an important skill for a high-performance athlete because difficult thoughts and emotions are a very natural, inevitable part of being a human, and are especially common during competitive sports.
- As such, it is not the presence of uncomfortable thoughts and feelings that is the problem, but rather how a person relates to those discomforts.
- In other words, trying to suppress and problematise the noise may make the noise louder in the long term, not quieter.

- Mindfulness can help with the acceptance of noise, without letting the noise have a a negative impact on behaviour, performance, and well-being.
- Similarly, mindfulness can help athletes focus on the task at hand, rather than focus on thoughts and emotions which may interfere with their ability to perform.
- Can you think of a well-learned skill you have acquired in your sport where you do not necessarily have to think about it to execute it?
- When athletes are under stress they are inclined to focus on perfecting well-learned 'automated' skills to enhance the feeling of control over the situation. For example, 'overthinking' tiny details, like where your stick meets the ball as you move across the field. These skills are best executed without conscious thought. When a person attempts to control well-learned foundational skill with conscious effort, that skill can become impaired.
- Athletes tend to describe this experience of overthinking details with the feeling of stiffness rather than fluidity and effortless movement, or behaviour in which frequent mistakes are made.
- Mindfulness can help athletes focus their attention on task-relevant cues, reduce the effort sought to control thoughts and emotions, and better manage performance pressure—all of which may enhance performance under pressure.
- Other benefits of mindfulness include an increase in dispositional mindfulness where mindfulness becomes more of a day-to-day habit.
- For example, formal mindfulness training promotes neuroplasticity in the brain by creating new neural pathways that reinforce attentional control and self-regulation, thus helping athletes better adapt to challenging situations across many facets of life. This behaviour can be compared to strengthening a particular muscle—the more you use it, the stronger it can become. The brain works in a similar way; it changes in response to experiences. Mindful experiences create mindful connections in the brain.
- Mindfulness practice is associated with decreased levels of perceived stress, burnout, and an increase in an athlete's ability to experience positive stress, which acts as a trigger for flow state and optimal performance.
- Mindfulness helps athletes to perceive stressful experiences more objectively, without letting stressful situations impair their performance.

- Mindfulness has been shown to enhance athletes' psychological flexibility, which is about being able to adapt to changing situational demands in pursuit of their goals and values.
- Mindfulness has been proven to increase athletes' self-compassion. This is achieved when a person separates themselves from their thoughts and emotions to promote kindness towards oneself. Outcomes associated with mindfulness and self-compassion in athletes include less self-criticism, rumination (worrying) and concern over mistakes, as well as better performance.

The Importance of Practice

- Practice is important when it comes to gaining direct benefit from mindfulness training. Athletes committed to mindfulness practice experience greater benefits such as decreased perceived levels of stress, increased psychological flexibility, self-compassion, and performance.
- As previously mentioned, formal mindfulness practice has been shown to result in neuroplasticity where the brain creates new neural pathways mindfulness and benefits associated with mindfulness, such as the ability to cope with stress becomes more second nature.
- Without adequate practice mindfulness is unlikely to become sufficiently embedded and habitual. If mindfulness is not a habit, athletes must consciously reflect on the need to be mindful.
- What does this mean for your performance? If you are under pressure during a competition, those parts of your brain responsible for executing newly learned skills, such as mindfulness, can become impaired. This means you are likely to struggle to benefit from mindfulness when you're stressed. However, consistent and regular mindfulness practice assists in building neural pathways to enable mindfulness to become second nature. This allows you to adapt and deal with stress when you need to most.

3. Mindfulness and Meditation

- Meditation is one method of practicing mindfulness.

- Regular meditation practice has several benefits already discussed, which are especially relevant for high-performance athletes.
- This study uses meditation as a primary means of practicing and benefiting from mindfulness.
- There are many misconceptions about meditation which often deter people from sticking to meditation practice. Some of the main misconceptions are as follows:

1. “I can’t stop my mind from thinking.”

Meditation is about a nonjudgmental awareness of your thoughts and emotions without the need to control them. Meditation is not about not thinking. There is a difference between having negative noise inside your head (which is often inevitable) and fusing to or identifying with that negative noise inside your head. The 1 Giant Mind Meditation technique, will teach you to witness thoughts without the need to control them or eliminate them.

2. “I’m not the type to meditate.”

There is no type - meditation is not a religion, a cult, or a fad. Meditation practice is recognised as one of the most basic, fundamental forms of self-care. Benefits include improved cognitive functioning, increased positive emotions, reduced inflammation, anxiety and depression as well as improved sleep and recovery from injuries and enhanced performance.

3. “I don’t have time to meditate.”

People often confuse not having sufficient time to meditation with not making it a priority. In order to benefit from mindfulness, it can be helpful to think about your values and priorities, and what you do with your time should reflect those values and priorities.

4. “Meditation makes me feel bad.”

When you stop and take a moment to observe your thoughts and feelings, it can feel uncomfortable, as often those thoughts and feelings are uncomfortable. Giving yourself space to accept discomfort will help you to defuse (distance yourself) from uncomfortable thoughts and emotions by changing how you relate to those thoughts, without needing to change and

control the content of them. Ignoring discomfort or trying to control it can make letting go of stress very difficult. Allowing yourself space to be with (accept) and let go of (defuse) uncomfortable thoughts and emotions, can lessen the negative impact of such experiences. Think of carbonated contents inside of a fizzy bottle of coke as your stress. Now think of meditation as slowly releasing the pressure from a bottle of coke instead of letting it explode everywhere after it has been rolling about in the back of your car for a week. It is okay for meditation to feel uncomfortable. The goal is not to promote relaxation and comfort, but rather an awareness and acceptance of discomfort. Relaxation is an additional bonus.

4. '1 Giant Mind: Learn to Meditate'

- The importance of practicing mindfulness in order to make it more of a habit, rather than something to fall back on only when required should now be understood.
- Phone applications are both a convenient and effective means of practicing mindfulness over time. A great deal of research has shown how mindfulness apps can help to integrate mindfulness into a daily practice for athletes and people with busy schedules.
- The mindfulness app used for this study is called '1 Giant Mind: Learn to Meditate' and has been created to make ancient meditative knowledge and skills, modern, relevant and accessible to everyone.
- This particular phone application has been chosen because it teaches a meditation technique that makes meditation a self-sustaining practice which once learned, does not rely on a smartphone or instructor for guidance.
- The app covers key processes of mindfulness related to changing how a person relates to thoughts, emotions and sensations with a non-judgmental attitude in an easily consumed manner.
- As part of the 12 days of learning, the phone application teaches knowledge and skills aimed to make formal meditation practice relatable to life outside of meditation. This is a key point of difference compared with other meditation apps, some of which fail to educate app users on the process of meditation.

5. Study procedures

- In the next few days, you will begin the '1 Giant Mind - Learn to Meditate' program which consists of 12 days of learning, followed by 30 days of practice. This will take approximately 15 - 20 minutes of your time each day.
- You will be given an option to complete the 12 days of learning in a single 3-hour session, but **PLEASE DO NOT USE THIS OPTION**. For the research to be effective, it is important for you to use the entire 12 days to complete the 12-day learning block before commencing the 30-day challenge.

[illustration using screen shots to clarify key steps relating to setting up and using the of 1 Giant Mind app]

1. The 1 Giant Mind meditation app is free to download on any smartphone. You can search for this app in your app store by typing in '1 Giant Mind'.

2. Download the app on your smartphone.

3. Once downloaded, open the app and select 'Register now'.

4. Add your name, email, age, and create a password.

5. The app will give you thorough instructions which I will now briefly go over.

6. You will come across a page with, 'Learn to Meditate in 12 Easy Steps'. Follow the 'Easy audio Instruction. We suggest doing one step a day for 12 days.

7. You will have the option to do more than one step in a day, but PLEASE do these 12 steps over 12 days, as recommended.

8. The 30-day challenge will only be unlocked once you have completed the 12 steps.

9. Once you are ready for your first session, select "Let's get started".

10. Select “Start Step 1” and press play to listen to the audio introduction and Step 1.

11. Each of the 12 steps goes for 15 minutes.

12. At the end of each step, you can access a 'Review your experience video library’ to help you understand your experience of meditation and refine your practice. This also includes functions like a journal and ‘Set a reminder’ tool to help you with your practice.

13. At the end of the 12-step course, you will have learned an Automated Self Transcendental meditation technique. You will then be required to participate in the ’30-day challenge’ to make meditation more of a daily habit.

14. You can use your preferred variable timer option to choose to meditate with male or female guidance, in music or in silence, with options ranging from 10, 15 and 20 minutes.

15. The 1 Giant Mind app gives thorough instructions throughout, so all you need to remember from this is the name of the app to download and to please participate in the ‘Learn to Meditate in 12 Easy Steps’ over 12 days before the 30-day challenge.

6. Questionnaires

- You have already done your baseline testing.
- You will be required to complete these same questionnaires on Day 14 and on Day 28. You will be reminded a few days before and one the day of needing to complete and send in your questionnaires.
- At the end of the study, you will complete those same four surveys once a week, for a minimum of three weeks.

You can find more information about the study procedure on your information sheet. If you have any questions or concerns at any point throughout the study, please send an email to [redacted] or call or text the contact numbers provided.

[text of primary researcher and research supervisor contact details]

We are more than happy to talk.

Thank you so much for choosing to participate in this study.

Appendix K: Methodology Flow Diagram