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Mindfulness-Based Practices for the Impaired Performance Athlete

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MINDFULNESS-BASED PRACTICES FOR THE IMPAIRED PERFORMANCE ATHLETE

By

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Abstract

Mindfulness-based programs are becoming commonly considered for the improvement of athlete's mental and physical state. However, their usage in improving performance in impaired athletes is limited and not fully understood. The purpose of this thesis was to review the standing literature on the topic of the application of mindfulness to improving athletic performance in wellbeing-impaired athletes. Seventy-three articles were included as references for this paper describing functional mechanisms, clinical significance and anecdotal evidence that points to the effectiveness of mindfulness in sport for the treatment of pain, injury recovery, prevention of injury, and chronic illness. Ultimately, this review supports the use of mindfulness in traditional sports performance contexts as well as its clinical application to aid recovery in unhealthy or performance-impaired athletes.

Introduction

It is not uncommon to find a sports psychologist employed by collegiate and professional teams whose job is to provide expertise on enhancing individuals' as well as the team's performance. In fact, Michael Jordan even credits his ability to lead the Chicago bulls to six NBA championships to George Mumford, the team's sports psychologist during Phil Jackson's time as the head coach (Mumford, 2016). Other well-accomplished athletes such as Kobe Bryant, Clint Dempsey, Sasha Cohen and many others also attribute a portion of their success to the assistance of sports psychology and mindfulness in particular. And, while psychological techniques such as mindfulness are being used, it remains a relatively niche technique and has yet to be implemented across athletics to its full potential.

Currently, psychological tools such as goal setting, visualization and positive self-talk are commonly used to improve sports performance across many levels of competition. For decades, researchers have found that goal setting is a consistently reliable intervention for improving performance in both sport and academics, and is used by coaches and teachers alike (Pemberton & McSwegin 1989, McClements & Botterill 1984, Gould 1993). This use appears justified as research has found that those that use goal setting improve their performance to a greater degree than those that don't (Kyllo & Landers 1995). In addition to goal setting, research has found many forms of imagery, including cognitive, motivational and outcome-based visualization, are also effective in improving sport performance (Taylor & Shaw 2002, Martin et. al 1999). For example, positive imagery improves golf putting performance whereas negative imagery decreases performance (Meacci and Price 1985, Woolfolk et. al 1985). While goal setting and

visualization are focused on external outcomes, self-talk is a more contemporary technique in sports psychology focused on adapting intrinsic motivation to promote a positive outcome. Indeed, self-talk that focuses on changing an individual's thoughts can have a positive impact on behavior and action (Hatzigeorgiadis et. al 2011). Beyond improving performance, encouraging positive self-talk can also facilitate the learning of new skills. (Rokke & Rehm 2001). On their own, these psychological techniques have been shown effective in improving performance, however, their efficacy may be improved further when combined with techniques such as mindfulness. To date, however, our understanding of mindfulness on its own and in combination with other techniques is limited, and therefore the overarching aim of this thesis is to review and evaluate the usefulness of mindfulness for improving athletic performance.

But what is mindfulness? Mindfulness is the practice of paying attention, often in relation to the body or the mind, in a purposeful and nonjudgmental way (Kabat-Zinn 1990). The practice has been shown to broadly reduce self-reported anxiety, depression, stress, and improve cognition (Ziedan & Vago 2016). While mindfulness can be present as a dispositional trait, it can also be developed using different types of training, meditation being the most common. However, to maximize the effectiveness of mindfulness training it is key that two components of mindfulness meditation are both present.

Mindfulness meditation is often separated into two components. These two components can be generalized as a focus of attention on present moment experiences, called Shamatha, and acceptance of both internal and external experiences, called Vipassana (Baer 2009, Bishop et al., 2004, Lindsay & Creswell, 2017, Zeidan & Vago

2016). In Shamatha, an individual is instructed to focus on both sensations in the body and associated feelings with emphasis placed on awareness of the quality and characteristics of each sensation and feeling. During Shamatha, the individual is encouraged to acknowledge when attention drifts from their present focus and to re-focus their attention on specific current sensations and feelings. Therefore, Shamatha is an attentive and dynamic practice which is founded on awareness of breath, body, and mind. Vipassana, on the other hand, is focused on non-judgemental acceptance of the present-moment sensations, rather than an active appraisal of these sensations, as in Shamatha, and is a much more difficult practice to master. Vipassana is also known as the open-monitoring mental stance and is often only effectively achieved after extensive practice of Shamatha (Zeidan & Vago 2016, Zeidan et al., 2019).

Athletic performance can be improved through the long-term application of simple Shamatha techniques such as body scans or mindful breathing on their own, even without the mastering of Vipassana (Thompson et al.,2011, Sappington & Longshore, 2015). To perform body scanning, an individual brings attention to the different parts of their body in a gradual sequence, noticing any sensations present (such as pain, tension, comfort or discomfort). Mindful breathing is often performed after body scanning is completed. Once an individual is aware of the sensations in his or her body, attention is drawn to the rhythm, quality, and sensation of breathing. While the mind may occasionally drift from awareness of breath, the practice encourages a re-centering of attention back to the body. When both mindful breathing and focus of attention to sensations in the body are performed together, the Shamatha technique is accomplished. While Shamatha techniques alone may show some improvement in performance, it has

been theorized that athletes who are more aware of their body's response, in a nonjudgmental manner, such as in Vipassana practice, can increase their ability to focus on task-relevant stimuli, and therefore make better overall decisions thus improving performance.

To facilitate the use of mindfulness techniques, programs have been developed to train the unexperienced in the practice of mindfulness. The first of these programs has been credited to the mindfulness-based stress reduction program from the 1970s, which has been adapted to form the foundation of many different interventions since (Black & Slavich 2016). One of the most implemented programs in athletics is based on a model of the relationship between mindfulness, acceptance, and commitment, and is an intervention aimed at enhancing both the performance and psychological well-being of elite athletes (Ivarsson et al., 2015). In this intervention, athletes participate in a multi-phase program focused on integrating various aspects of mindfulness with the identification and interpretation of the athletes' personal values, as well as encouragement of athletes to engage in value-driven behaviors (Gardner & Moore 2012). Body-scanning, breathing techniques, and other mindfulness techniques are central to the success of programs using this model.

While the application of mindfulness to sport itself is not new, its use in athletics has been often limited to the improvement of healthy athletes' performance. A few areas that might benefit from these techniques, but in which they are not yet widely used, is in the treatment of chronic and acute pain, injury prevention, and stress-induced digestive illness. In the athlete, specific mindfulness tactics can be utilized to improve an individual's awareness of the mind's connection to body for the purpose of reducing

anxiety, stress, and even physical pain (Mohammed et al., 2018). However, given mindfulness' known benefits to overall wellness, these practices may also benefit illness management and recovery. Therefore, the specific aim of this thesis is to review the benefits of implementing mindfulness-based practices to improve the wellness of impaired or injured athletes. In this thesis, I will review mindfulness' impact on variety of topics including injury recovery and pain tolerance, injury risk reduction and digestion disruption. In doing so I will also discuss the application of mindfulness to clinical practice. Ultimately, I find that there is evidence that mindfulness may benefit athlete's recovery from many facets of illness and therefore athletes' wellbeing and performance could benefit from continuing education, research and the application of mindfulness practices to the field of sports medicine.

Enhanced pain tolerance and recovery from injury

Pain tolerance, while difficult to objectify in the clinical setting, is a key element in the recovery of injury. An athlete's tolerance to pain can directly influence their commitment to rehabilitation, willingness to progress through physical therapy, and ability to play through periods of minor pain (Mohammed et al., 2018). In fact, self-reported pain immediately following injury and general sensitivity to noxious heat or cold, are predictors of lingering moderate to severe pain months after acute injury (Williamson et al., 2009, Sterling et al., 2006, Kasch et al., 2005, Walton et al., 2011, Lentz et al., 2009, Pierik et al., 2016, George & Stryker 2011). Cold hyperalgesia is found to be predictive of chronic pain in patients experiencing nervous system-related conditions, such as whiplash, and can be partially explained by psychological

mechanisms (Sterling et al., 2006). This emphasizes the need to better understand the psychology of pain, and psychological intervention's ability to disrupt the development of chronic pain from acute-onset injury.

To understand the psychology of pain it is useful to examine how different psychological dispositions are associated with varying patterns of brain activity in the presence of pain. For example, individuals with higher dispositional mindfulness show greater deactivation in regions of the brain involved in sensory, cognitive, and affective appraisals of pain, suggesting that mindfulness may reduce pain appraisal and potentially increase pain tolerance (Zeidan et al., 2018, Zeidan et al., 2019). In contrast, those who sit low on the trait mindfulness spectrum tend to exhibit lower pain tolerance (McCracken et al., 2007, Petter et al., 2013, Schutze et al., 2010).

There is hope, however, for those with low trait mindfulness, as mindfulness can also be improved via training. Interestingly, different functional areas of the brain are activated in those undergoing mindfulness training compared to those with dispositional mindfulness (**Table 1**) (Zeidan et al., 2016, Zeidan et al., 2015, Taren et al., 2017, Fadel et al., 2019, Zeidan et al., 2019). For example, pain-relief observed following short-term meditation is associated with activation of brain regions involved in acceptance, coping, and reappraisal. This increased activation contrasts with the deactivation of brain regions associated with affective response to pain in those with dispositional mindfulness (Wang et al., 2019). Extensive mindfulness training has also been found to decrease activity in the appraisal-focused prefrontal cortex while activity in the somatosensory cortex is increased (Gard et al., 2012, Grant et al., 2011, Zeidan et al., 2019). Given different brain regions' association with pain and the different patterns of activation associated with

different types of mindfulness training or disposition (Table 1), a clinician could potentially prescribe the components of mindfulness training with the aim of selectively combating either acute or chronic pain.

Regions of Brain Activation in Response to Pain that are Associated with Mindfulness

Resource	Trait Mindfulness	Brief Mindfulness	Extensive Mindfulness	Suggested Mechanism
Zeidan et al., 2016		↑ activation: OFC, sgACC, anterior insula	↓ activation: appraisal related regions (vmPFC) ↑ activation somatosensory cortex	*Brief:* Higher-order re-appraisal *Extensive:* Decoupling: sensory and appraisal-related regions
Zeidan et. al., 2015		↑ modulation (orbitofrontal, subgenual anterior cingulate, anterior insular cortex)		*Brief:* Higher-order re-appraisal *Placebo:* Active appraisal and deactivation of sensory
Taren et. al., 2017		↑ resting state functional connectivity: dlPFC and frontoparietal regions		*Brief:* ↑ higher-order executive activity, regulation of attention, decision making, and cognitive control
Fadel et al., 2019	↓ activity: posterior/midline nodes of default mode network (PCC/Precuneus)	↑ modulation (orbitofrontal, rostral anterior cingulate cortex)	↓ activation prefrontal cortex ↑ activation somatosensory cortex	*Trait:* ↓ connectivity of sensory and apprasial *Brief:* Higher-order regulation and re-appraisal *Extensive:* Decoupling of sensory and appraisal regions
Zeidan et. al., 2019	↓ activity: precuneus to PCC			*Trait:* ↓ sensory, cognitive, and affective appraisal

Table 1. Summary of the regions of the brain activated via trait mindfulness and mindfulness training, as well as the correlating mechanism of pain relief.

Acute Pain:

Short-term mindfulness training has been shown to be associated with significant reductions in present-moment pain intensity (Zeiden et al., 2019). While the mechanism by which these reductions affect pain are still unclear, functional MRI (fMRI) of patients after performing brief-mindfulness training have shown activation of the orbitofrontal and rostral anterior cingulate cortex which may aid in the reduction of perceived pain (Zeiden et al., 2015, Zeidan et al., 2019). One possible way mindfulness may reduce pain is through modulation of cortical networks associated with emotion and attention. FMRI performed during brief mindfulness training shows increased resting-state connectivity between the dorsolateral prefrontal cortex (dIPFC) and ventral networks which are associated with emotional processing and attention (Taren et al., 2017). Together these results suggest that brief mindfulness training can modulate cortical networks in a manner that may facilitate the tolerance of pain.

Interestingly, the fear-avoidance tendencies of patients recovering from acute pain can predict the likelihood that acute pain will transition into chronic pain (Lentz et al., 2009, Pierik et al., 2016). For example, patients who displayed fear of pain following an acute-onset of lower back pain (LBP) have a higher incidence of chronic LBP (Vlaeyen & Linton 2000, Fritz et al., 2001). The relationship between fear-avoidance and chronic pain appears greatest in musculoskeletal conditions such as LBP, anterior cruciate ligament reconstruction, shoulder pathology, and ankle injury (Lentz et all., 2009, Pierik et al., 2016; George & Stryker 2011). These results suggest that by increasing tolerance

to pain, to reduce fear-avoidance, through interventions such as mindfulness training, fear of pain and the probability of acute pain transitioning to chronic pain, could be reduced.

Compared to acute pain, the mechanisms behind the experience of chronic pain are more complicated, and models such as the fear-avoidance model have been developed to better understand and describe these mechanisms. In the fear-avoidance model, unintentional judgement and fear of pain results in delayed confrontation of pain, which can lead to chronic mistreatment of injury and pain (Schutze et al., 2009, Pierik et al., 2016). Mindfulness practices, which are built on the concept of intentional awareness of the present moment without cognitive judgement, can act as an interference in the cyclical fear-avoidance model of pain. For example, researchers have argued that decreasing avoidance behaviors, such as catastrophization of pain, can decrease the incidence of such chronic pain development (Lentz et al., 2009, Pierik et al., 2016, George & Stryker 2011). While some have suggested using mindfulness to interrupt the cycle of fear-avoidance, the timing is key (see **Figure 1** for a suggested implementation of mindfulness in the fear-avoidance model). Because of timing's importance, highlighting the benefits of mindfulness training in light of the fear-avoidance model can give patients a better understanding of the efficacy of mindfulness training *early* in recovery, when implementation of mindfulness training could potentially reduce the likelihood of chronic pain developing.

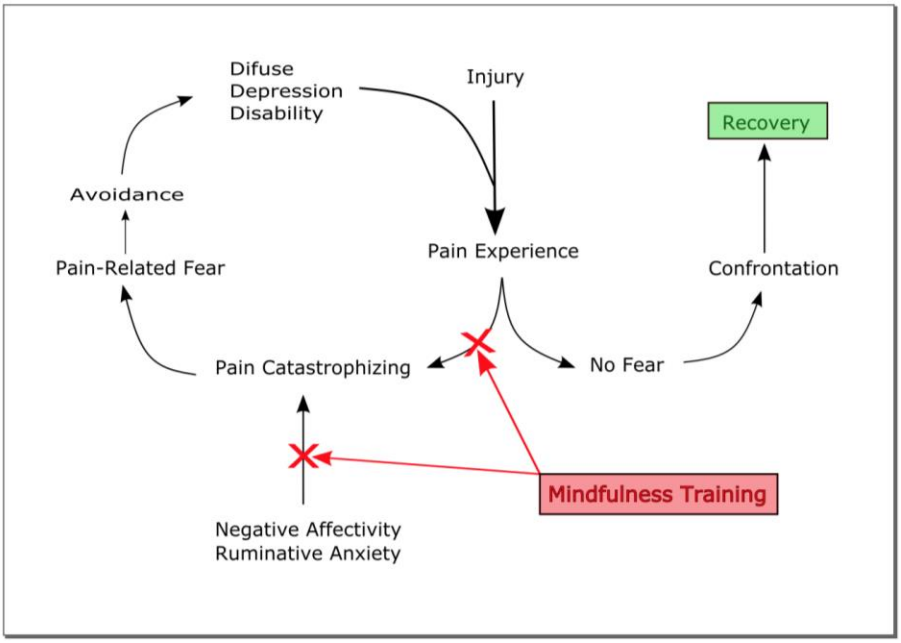

Figure 2. Suggested adaptation of the fear-avoidance model for the implementation of mindfulness training. According to the model, an individual is supposed to have two paths for handling pain; either approaching the pain without fear which leads to direct recovery through confrontation, or facing pain with anxiety and fear, causing a cyclical response to pain leading to chronic disability. Mindfulness can act as a pain intervention by reducing catastrophization and pain-related anxiety, breaking the cycle and redirecting the process toward recovery. (Adapted from Schutze et al., 2010)

Chronic Pain:

As of 2008, the Medical Expenditure Panel Survey estimates that over 100 million adults in the United States are affected by chronic pain, resulting in an economic burden of around $600 billion dollars between healthcare costs, work missed, and lower wages due to reduced functional ability at work (Gaskin & Richard 2011). While chronic pain can affect many parts of the body, LBP is generally the most common location identified in general and athletic populations. In elite athletes, LBP is present in between 49% and 81% of athletes (Fett et al., 2017, Trompeter & Platen 2017). Current data suggests that around 30% of both contact sport and non-contact sport athletes report missing playing time or competition due to back pain (Mortazavi et al., 2015). While

currently there is limited data describing the cost and percentage of time lost in practice and competition due to chronic pain in other regions of the body, it is likely that any form of chronic pain is detrimental to performance and success in sport.

Current options for treating chronic pain include injections, oral medication, and surgical procedures alongside rehabilitation. However, medication given via injections often provides only a temporary relief from pain, and oral medications can be addictive and costly (Hilton et al., 2017). The CDC estimated that prescription opioid misuse alone causes an economic burden of $78.5 billion a year in the United States (Florence et al., 2016). Beyond the concern of medication misuse, a portion of the chronic-pain plagued population is searching for alternative treatments that do not require invasive procedures such as surgery.

Mindfulness practices have been shown to be effective in the management of chronic pain and in decreasing self-reported present-moment pain, reducing medication use, and improving overall quality of life (Kabat-Zinn et al., 1985, Hilton et al., 2017, Veehof et all., 2016, McCracken & Vowles 2014, Kabat-Zinn 1982, Gardner-Niz, 2009, Teixeira, 2008, Grossman et al., 2007, Morone et al., 2008, Chiesa & Serretti 2011). The rather wholistic benefits of psychological strategies on chronic pain management suggest that the clinical application of mindfulness programs for chronic pain should be more widely adopted as a synergistic treatment with medication or rehabilitation. In a systematic review focusing on the implementation of mindfulness meditation programs for chronic pain patients, decreased pain was noted in 30 randomized controlled trials (Hilton et al., 2017). In one study, ninety patients with chronic pain were trained in mindfulness meditation as part of a 10-week stress reduction and relaxation program

(Kabat-Zinn 1985). Significant reductions in present-moment pain, inability to complete daily activities, and psychological symptoms such as depression and anxiety were observed in the treatment group.

Physiologically, specific areas of the brain associated with pain processing are less active during mindfulness practice which are more active during placebo treatments, such as the prefrontal cortex (Zeidan et al., 2016, Zeidan et al., 2015, Taren et al., 2017, Fadel et al., 2019, Zeidan et al., 2019). In addition, patients experiencing chronic pain after performing long-term mindfulness practices appear to exhibit greater decoupling between sensory experience and cognitive contextualization of pain when compared to a brief meditation group (Zeidan et al., 2019). This effect is observed in those that have completed extensive mindfulness training prior to functional imaging, as increased activity in the somatosensory cortex and decreased activity in the appraisal-focused prefrontal cortex is measured using fMRI (Gard et al., 2012, Grant et al., 2011, Zeidan et al., 2019). The decrease in pain experienced following long-term mindfulness training has been explained as a decoupling of appraisal and sensory regions of the brain, forming a non-appraisal mechanism for managing pain.

Additionally, dispositional, or trait mindfulness has also been associated with changes in higher order cortical connectivity. Specifically, decreased interaction of the posterior cingulate cortex (PCC) and the precuneus has been noted in the fMRI of patients who present with an increased level of dispositional mindfulness (Zeidan et al., 2018, Zeidan et al., 2019). While the PCC functions in more sub-conscious self-referential ways, the precuneus is critical in memory and affective response to pain. This

decreased connectivity implies that those with higher trait mindfulness may experience less pain related cortical activity.

Clinical Application:

The findings from fMRI studies may be useful in understanding how the practice of mindfulness may benefit recovery from injury and rehabilitation in the clinical setting. For those experiencing acute pain, the specific coping mechanism suggested by fMRI research is a re-appraisal of pain. In this case, the Shamatha phase of mindfulness meditation could be effective in reducing acute pain due to its focus on awareness and appraisal of sensation throughout the body. On the other hand, with patients experiencing long-term pain, Vipassana techniques are more likely to be beneficial due to the focus on disassociation between sensory and appraisal regions in the brain.

More specifically, in order to decrease acute pain intensity during rehabilitation, mindfulness practice can be briefer and focused more on awareness of breath and sensations in the body as described in the Shamatha phase of mindfulness meditation. On the other hand, an individual needs to be able to tap into the open-monitoring mental stance (non-appraisal of emotion and thought in Vipassana) versus the singularly focused-attention practice (such as appraisal of sensation in Shamatha) in order to more effectively combat long-term pain (Zeidan et al., 2019).

Further research into, and awareness of, these techniques and their benefits could be beneficial to medical professionals (Tatsumi & Takenouchi 2014). Since mindfulness training appears to help moderate emotions, which could benefit recovery, research is necessary to determine which emotions are elicited at specific stages of injury recovery

and determine how these emotions are impacted by mindfulness training. This information could be particularly beneficial to the clinician if it impacts patients' acceptance and dedication to rehabilitation during periods of acute pain. While evidence is present suggesting mindfulness may benefit injury recovery, it has yet to be well implemented or studied. Similarly, another area that could benefit from mindfulness training, which has not yet been widely considered, is its use as a tool for injury prevention.

Injury Risk/Prevention

The CDC reported that in a 5-year period (2009-2014) over 210,000 sport-related injuries occurred each year across all competitive divisions of the NCAA. Of these injuries, 21.9% required more than 7 days of recovery prior to return to full participation, 3.9% required surgery, and just under 1% required emergency transport (Kerr et al., 2015). While many strategies have been implemented by the NCAA and medical professionals working in college athletics to reduce time-loss injuries, a majority of strategies focus on physical well-being through policy changes and physical training. However, athletes who experience higher levels of stress are at a greater risk of injury, suggesting psychological treatment may also benefit injury avoidance (Petterson & Olson 2017, Ivarsson et al., 2015, Galambos et al., 2005, Williams & Andersen 1998). Though the evidence is consistent that a history of psychological conditions, active disordered eating and high values of self-reported stress have a positive relation to injury incidence, prevention strategies have often failed to address psychological antecedents of sport injury.

Williams and Andersen (1998) proposed that both psychological and physiological stress responses are directly linked to injury risk. Responses to stress such as attentional disruption, anxiety, generalized muscle tension, and poor decision-making place the individual at heightened risk for a wide range of injuries. However, this risk may be reduced through mindfulness training's stress reducing effects. Specifically, mindfulness-based interventions have found that mindfulness practitioners are better at discarding the irrelevant external stimuli that contribute to stress, resulting in individuals appraising situations as less stressful than prior to mindfulness training (Ivarsson et al., 2015). The relationship between stress and athletic injury is closely tied to the aforementioned cognitive appraisal model, which reinforces the idea that conscious or subconscious appraisal can influence one's physical state and reaction to stimuli. Through such appraisal, mindfulness-based practices could indirectly decrease injury incidence by increasing attentional control, decreasing muscle tension, and improving decision making.

While it is clear that mindfulness training can positively influence factors related to injury, a direct link between mindfulness and injury avoidance has yet to be formally established due to mixed findings. For example, one study followed a group of gymnasts who performed common psychological training in the form of relaxation, imagery, and positive self-talk and its effect on injury incidence. Those in the treatment group experienced fewer injuries than those in the control group (Kerr & Goss 1996). In comparison, a mindfulness-based study performed with elite soccer players found 67% of athletes in the treatment group remained injury free in comparison to only 40% in the control group. At first glance these two studies appear to have similar outcomes, however

in this latter study the authors found that the reduction in injuries associated with mindfulness training was not statistically significant. Though the lack of a statistically significant difference in injury rate between the two groups could, perhaps, weaken support for a link between mindfulness and injury reduction, it could also suggest insufficient statistical power to resolve a difference between the treatment and control group. Regardless of the statistical outcome, the latter study ultimately recommended daily implementation of mindfulness-based practices for the reduction of injury incidence, and the clinical significance of both studies is evident. (Ivarsson et al., 2015).

Clinical Application:

Programs such as the Mindfulness, Acceptance, and Commitment program used in conjunction with current evidence-based practices for injury prevention have contributed to significant improvements in injury treatment and recovery. These benefits are likely due, at least in part, to stress reduction and improved overall mental well-being. Because of this, mindfulness training should be considered in the treatment of chronically injured athletes. In addition, improvements in the ability to focus and discard distractions associated with mindfulness training may also play an important role in reducing the attentional distractions that contribute to increased injury risk (Williams and Anderson 1998). Therefore, the implementation of psychological skills training such as mindful breathing, body scanning, and other attentional practices may be beneficial for athletic injury prevention. However, while evidence suggests mindfulness training may be beneficial to injury prevention, management and recovery, more research is necessary to better elucidate the nature of these relationships.

Stress-based digestion conditions

Gastrointestinal (GI) tract health is important to the performance of endurance athletes, as it plays a critical role in delivering important nutrients and fluids to the body during prolonged exercise. However, symptoms of GI tract disorders such as bloating, irregular bowel movements, and stomach pain are present in 30-70% of the athletic population (Jeukendrup 2017, Killian & Lee 2019, Diduch 2017). In endurance athletes, the prevalence of Irritable Bowel Syndrome (IBS) is high, with over 50% experiencing at least one symptom during activity, and these athletes generally report a higher percentage of lost practice or competition time compared to athletes without GI symptoms. (Killian & Lee 2019). With up to 70% of elite athletes admitting that upper or lower GI symptoms have negatively affected their training or performance during competition, such symptoms need to be addressed to improve performance (Diduch 2017). Beyond mindfulness training's ability to potentially reduce injury risk and aid recovery, its ability to reduce stress may have a significant impact on the treatment of chronic health conditions in the digestive system, such as IBS and disordered eating (Cherpak 2019).

While stress can be positive in the performance context, facilitating increased physiological load and competitive performance, chronic stress can lead to an impairment of metabolic reserve, which is used to respond to increased workloads on the body. Though the body is designed to return to homeostasis following stress, chronic stress contributes to gastrointestinal issues and chronic disease by impairing the return to homeostasis (Cherpak 2019). In the athletic population, chronic stress is often due to

over-exertion and prolonged exercise, but too often the treatment of IBS leaves out the possible etiology of daily and mental stressors.

The stress-digestion-mindfulness triad, which represents the relationship between the physiological impact of stress on digestion with associated changes in the nervous and endocrine systems, emphasizes the connection of stress to digestive malfunction and encourages psychological intervention. Stress is specifically known to disrupt digestion by reducing blood flow to the GI tract, increasing inflammation, decreasing stomach acid, impairing vagus nerve activity, and more (Cherpak 2019). The stress-digestion-mindfulness triad suggests that not only can mindfulness directly modulate the stress response, but it also promotes PSNS dominance in the normalization of gastric activity.

While common treatments for athletes experiencing IBS such as medication and diet change have been widely recommended (Jeukendrup 2017, Killian & Lee 2019, Diduch 2017, Calrk & Mach 2016), a portion of the affected population are being left behind as these treatments may not reduce the daily stressors that cause the majority of symptoms. Indeed, the stress reduction properties of mindfulness training could provide an effective means of treating stress related digestive issues. Introducing mindfulness in conjunction with other treatments, such as diet alterations and medication, could prove incredibly beneficial for athletes by more holistically addressing the causes of stress along with the symptoms.

Clinical application:

Patients with IBS have been observed to benefit from diaphragmatic breathing and body scanning, via meditative mindfulness, through both preventative and

therapeutic intervention (Black & Slavich 2016). Such practices should be considered more heavily to aid treatment of chronic digestive illness, particularly when medication and diet change alone have not been successful in alleviating symptoms.

Beyond the straightforward meditative practices of mindfulness, mindful eating has been suggested to benefit individuals with IBS and disordered eating. In short, mindful eating encourages both awareness of sensations and reflection during the process of eating, alongside separate mediation exercises (Cherpak 2019). To be most successful, a clinician is recommended to work along-side the patient recording self-reported symptoms and objective measures of digestive wellbeing to recognize and evaluate progress (Framson et al., 2009). During the intervention, individuals learn to focus on the taste, texture, and emotions they experience while eating. The process has been shown to increase parasympathetic nervous system activity, which is associated with stress reduction (Cherpak 2019, Clark & Mach 2016). Encouraging a response dominated by the parasympathetic nervous system is key to optimizing digestive function all while enhancing self-acceptance, mind-body awareness in relation to food, and overall health (Cherpack 2019).

Conclusion

The mental nature of pain is underappreciated and often misunderstood. Better understanding of how pain is registered and overcome in the brain can be extremely beneficial in improving treatment options. It has been suggested that athletic trainers and physical therapists should have more education on the role of sports psychology in injury recovery and athlete wellbeing in order to better expand their therapeutic toolkit and

develop an effective referral network (Ford & Gordon 1998, Heaney 2006). The sports medicine team functions as the medical frontline for athletes in traditional athletic training settings. Therefore, athletic trainers and sports medicine physicians alike must be prepared to identify a multitude of conditions ranging from physical injury and general medical conditions to mental health illnesses.

Further studies are needed to bridge the gap between the already established physiological effects of mindfulness and its plausible long-term impact on improving sport performance. However, current evidence already suggests beneficial clinical applications in sport. Several studies have illustrated the usefulness of mindfulness as an intervention to reduce the progression of acute to chronic pain; cohort studies have shown that mindfulness can decrease the incidence of injury through preventative measures; stress-reduction based mindfulness programs can decrease unhealthy stress to combat stress-digestion conditions such as GI dysfunction and disordered eating. While the sports psychologist may be the most effective profession for implementing some of these practices, access to such a role and funds to support the role is limited. Mindfulness could therefore be further considered as continued education components for medical professionals. More awareness and education on the benefits of mindfulness, both in anecdotal and evidence-based practice, is key for sports medicine professionals and athletes alike in the pursuit of elite athletic performance and well-being.

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