

The Killing of a Sacred Veneer: Depressive Symptoms in Athletes

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Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institutes of learning.

List of Publications

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Abstract

Within the past decade, there has been a growing research interest on mental health issues in athletes. Within this increasing area of research, research on depressive symptoms in athletes has been central. However, the overall depression-related evidence-base is still fragmented and several important areas of research remain under explored. The overall aim of this PhD was to map topics that have received little scholarly attention in the past, and to empirically explore novel research questions that could contribute to future research and applied work to improve support and prevention initiatives in athletes.

Study 1

The aim was to describe methodological characteristics of the research that has assessed depressive symptoms in athletes, and to map the variables that have been tested concerning these symptoms. A review framework proposed by Arksey and O'Malley (2005) was utilised, and of 6983 records screened, 157 studies were included. Most studies were cross-sectional, with samples including current male and female athletes from multiple sports and levels. Non-athlete comparison groups frequently consisted of student samples. Twenty-eight different depression scales were utilised, of which CES-D, BDI, BDI-II, and the PHQ-9 were most common. The most frequently tested variables in relation to depressive symptoms were identified as proximal contextual and interpersonal factors (67.9%), including sport-specific (e.g., type of sport) (36.4%), and generic (e.g. social support) (31.5%) factors. Within-individual factors (e.g. cognitive vulnerability) accounted for 17.2% of all observed topics/variables tested in relation to depressive symptoms, and 9.3% tested depressive symptoms in relation to comorbid disorders. Macro-level variables (e.g. ethnicity)

accounted only for 5% of all observations. Considering that current knowledge about depressive symptoms in athletes is largely based on cross-sectional data, and few studies have explored potential underlying mechanisms (e.g. cognitive vulnerability), more longitudinal research is needed to identify underlying vulnerabilities that predict individual differences in depressive symptoms over time. This would further improve future applied work to develop evidence-based intervention and prevention to target relevant mechanisms that increase athletes' likelihood of experiencing elevated depressive symptoms. The type of measures utilized across the reviewed studies were also highly variable, and different cut-off scores were used to identify athletes with clinically significant depressive symptom severity. Considering the methodological heterogeneity across studies, future studies could benefit from conducting more fine-grained analyses to explore the type of symptoms athletes may be experiencing rather than merely reporting prevalence rates based on a single cut-off score. This could improve our current understanding of the type of issues that may be especially relevant in the athlete populations.

Study 2

As identified in study 1 interpreting depressive symptom prevalence across previous studies is complicated considering the range of different measures and cut-off scores that have been utilized in previous studies. Furthermore, we know little about the type of symptoms that may be especially relevant in athletes. Hence, the aim of study 2 was to explore the prevalence of specific symptoms of depression in athletes, and to test differences in athletes' likelihood of exhibiting these symptoms depending on their age, sex, the type of sport, and the level of competition in which they engage. A sample of Icelandic male and female team sport athletes competing in football, handball, and

basketball (N=894, 18-42 years) were included in the study. The football sample represented 20.3% of the Icelandic adult football population (N=2170 across 105 teams) with a total of 441 participants included (age range 18-41 years, male 70.1%). For basketball, the sample represented 36.1% of the Icelandic adult basketball population (N=659 across 56 teams) with a total of 238 participants (age range 18-41 years, male 62.6%). For, handball, sample represented 26.5% of the Icelandic handball population (N=812 across 20 teams) with a total of 215 participants (age range 18-42 years, male 51.2%). Of the athletes exhibiting clinically significant depressive symptoms on the Patient Health Questionnaire (PHQ-9), 37.5% did not exhibit core symptoms of depression (i.e., depressed mood, a lack of interest). Compared to males, females were significantly more likely to exhibit depressed mood, feelings of worthlessness/guilt, problems with sleep, fatigue, appetite, and concentration. Within males, differences were mostly related to neurovegetative aspects of depression (sleep and appetite), whereas in females, differences were related to cognitive/emotional aspects (e.g. depressed mood, guilt/worthlessness). The findings underline the importance of exploring specific symptoms of depression to provide a richer understanding of depressive symptomology in athletes – consequently allowing future research to identify and target risk factors that may be linked to these specific symptoms.

Study 3

As identified in study 1, understanding individual differences in vulnerability to depression are still under explored in athletes. Therefore, the main aim of this study was to fill this gap by testing the influence of depressive rumination (repetitive thought processes in response to depressed mood) on the likelihood of experiencing clinically significant depressive symptoms in athletes. Depressive rumination, as defined in the

Response Styles Theory, is a well-supported cognitive vulnerability factor to depression within the general and clinical populations – but previous research in athletes has not explored this relationship. In this study, athletes’ profiles on the two underlying factors of depressive rumination, brooding (maladaptive) and reflective rumination (adaptive) were tested on athletes’ likelihood of exhibiting clinically relevant depressive symptoms. A total of 286 competitive athletes from 54 different types of sports were included in the study (62.0% male, age range 18-69 years). The majority of athletes were UK citizens (88.0 %) of white/Caucasian ethnic background (92.2 %). More than half of the athletes (53.5 %) had been selected to represent their country at some point during their athletic careers, and 30.5 % were currently competing at international/top tier professional level. The Patient Health Questionnaire 9 (PHQ – 9) was utilized to measure depressive symptoms, and the Ruminative Responses Scale (RRS-short form) was used to measure the two underlying dimensions of depressive rumination, brooding and reflective rumination. Compared to athletes with a low brooding/reflection profile, athletes with a high brooding/reflection profile had significantly higher odds of experiencing clinically relevant depressive symptoms (OR=15.24, 95% CI=4.37–53.24). A low brooding/ high reflection profile was not, however, related to increased odds. The findings validate findings in the general and clinical populations in the current athlete sample, suggesting that brooding rumination may be an important vulnerability factor explaining individual differences in depressive symptoms in athletes. This implicates that applied work may benefit from targeting brooding tendencies to help vulnerable athletes to develop more beneficial responses to negative mood. However, future research should validate the theoretical model of the response styles theory in longitudinal designs. Furthermore, as implicated by the theoretical model, depressive rumination should be related to increased depressive symptoms when

individuals are experiencing stressful life situations. Hence, future studies should test whether athletes with a higher tendency to engage in depressive rumination (especially brooding) compared to those with a low tendency, are more likely to exhibit increased levels of depressive symptoms when athletes experience increased levels of stress in their lives. This would provide stronger empirical support for depressive rumination as a potential underlying mechanism, consequently supporting the utility of targeting depressive rumination in treatment and prevention of depressive symptoms in athletes.

Study 4

In-line with suggestions for future research proposed by study 3, the aim was to validate the vulnerability-stress account of the response styles theory using a longitudinal research design. That is, study four tested whether between-athlete differences in the tendency to brood and/or reflect in response to negative mood, measured at the beginning of the study (i.e., baseline), would predict increases in depressive symptoms when levels of stress increased over the one-year study period. A total of 79 Icelandic elite and national team athletes were included in the study ($M=23.5$, $SD=4.8$, age range 18-37), with the majority being female athletes ($n=60$, 75.9%). Athletes competed in handball ($n=22$, 27.8%), football ($n=14$, 17.7%), basketball ($n=26$, 32.9%), Icelandic equitation ($n=8$, 10.1 %), and mixed martial arts and/or Brazilian jiu-jitsu ($n=9$, 11.4%). While depressive rumination (brooding and reflection) were measured at baseline, stress and depressive symptoms were assessed at baseline, at 6-months and 12-months post-baseline. The results showed that higher perceived stress and brooding, but not reflective rumination, independently predicted higher depressive symptom scores over the study period. Furthermore, brooding rumination measured at baseline significantly moderated the effects of individual fluctuations in perceived stress

on depressive symptoms. Hence, athletes who reported high brooding tendencies in the beginning of the study were more likely than those who reported a low tendency, to experience significantly higher increases in depressive symptoms when stress levels increased over the study period. The findings supported initial findings in study three and demonstrated the validity of exploring individual differences in depressive symptoms through the lens of the response styles theory in future research in the athletes. The findings also highlight that athletes who develop brooding rumination as a response to negative affect may be especially vulnerable to experiencing elevated depressive symptoms when levels of perceived stress increase. Future research may benefit from examining the influence of sport-specific developmental trajectories to better understand, and hence prevent, the development of brooding tendencies in athletes

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The Killing of a Sacred Veneer

Prologue

While his eyes were busy taking snapshots of the view streaming outside the bus window, he was stuck entertaining the stream of thoughts roaming inside his head. Like an unwanted quest, these thoughts had too many stories to tell – and even without a clear storyline, they echoed so loud. They engulfed his entire presence. He was coughed back into his seat to witness the sudden outbursts of brotherly insults that marked the end of a poker round taking place in the far end of the bus. Who won the round? How much was on the table? As he realized the absence of his presence, an abrupt silence announced the beginning of another round of poker. For him, the silence dealt a new thought. His eyes searched desperately for distraction, a place to hide, but he knew that his efforts were meaningless. It was better to surrender to the brooding blur. And as suddenly as the eyes open in the morning, his mind begun its abstract incoherency.

The cognitive life that we live is our private spectrum of existence – only available to others in dull graphics projected by the verbal summaries we choose to share. Although dull graphics can provide an enjoyable experience (I used to love playing Donkey Kong in the late 80's), they cannot provide the sense of lived experience that we experience when we engage in our inner life; go to future and past places, real and imagined, sometimes being completely free of, and sometimes getting desperately stuck in them. Yet, the inner life can present itself to the outside world in an indirect manner, through the explicit and implicit behaviours in which we engage in. We occupy an internal and external existence, in which both worlds can swiftly instigate a chain of inferences and subsequent behaviours.

Although we often engage deliberately with our inner projects, such as rehearsing an athletic routine, analysing past performances or thinking about the meaning of life - many daily behaviours, feelings, and sensations emerge without any

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apparent mental effort. I have observed the difficulty of athletes (and myself) of sometimes understanding and explaining why they feel and behave the way they do. An athlete tearing up when asked about a difficult experience seldom has a clear-cut answer to why they are crying. A more effortless response may come when questioning about the precipitating events – “well, I don’t know, you asked about my relationship with my coach and all these emotions just took over me”. Similarly, an athlete who scored eight shots on a par 3, disengaged and consequently played a terrible round of golf may state that “that hole just killed my round, there was just no point anymore”. Sometimes it may be easier to pinpoint the external events, rather than the (often highly automated) inner dialogues as the reasons for our emotions and behaviours.

The life experiences we cumulate over the years are the building blocks, the blueprint, from which we draw interpretations of the events the external world places before us. It is this “collision of worlds” that seem to give rise to conflicts in mental health. As discussed by Aaron T. Beck decades ago:

The complex system of environmental stimuli controls us only to the extent that it meshes with its psychological counterpart. Our inner workings can shut out or twist around the signals from the outside so that we may be completely out of phase with what is going on around us. A profound or chronic discrepancy between the internal and the external systems may culminate in psychological disorders (Beck, 1976, p.25).

I have had the opportunity to experience sports through the eyes of an athlete, a coach, a psychologist, father, and an “academic” (PhD pending). The scope of this thesis does not allow me to fully emphasize or to explore the breadth of experiences that

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I have gathered through these roles in sport, or at other life arenas. However, this thesis has allowed me to spend the last three years on a topic that I have long been curious about – depression in athletes. I have learned a lot, and more often, felt that I have not learned enough. Looking back at the last three years of my life, I hope that this work can provide some new insights into the important and timely topic of athlete depression.

CHAPTER 1: Background

Introduction

Within the past decade, awareness of athlete mental health issues and corresponding recognition of the importance of athlete welfare has occupied an increasingly important space in sport psychology literature and discourse (Gouttebauge et al., 2019; Moesch et al., 2018; Schinke, Stambulova, et al., 2018). As recently cited in the athlete literature (Kuettel et al., 2021; Küttel & Larsen, 2019; Uphill et al., 2016), Keyes' (2002, 2005) two-continua model defines mental health as an interaction between the mental illness and mental health continuums. The mental health continuum ranges from languishing (poor mental health) to flourishing (optimal mental health). Here flourishing is defined as an overall experience of positive emotions, psychosocial well-being, and functioning. Languishing, on the other hand, is defined as the lack of psychosocial well-being and functioning, with the lives of the languishing individuals generally described as empty and stagnant. The mental illness continuum in Keyes' (2002, 2005) model ranges from the presence of, to the absence of, mental illness. According to this two-continua model, mental health and mental illness are two distinct, but correlated, spectrums – where the absence of mental illness is not necessarily interchangeable with optimal mental health and vice versa (Uphill et al., 2016). Hence, the model proposes the idea that being free from mental illness does not automatically translate into optimal mental health - and having a mental illness does not necessarily mean that the individual lacks mental health. Therefore, the two-continua model implicates that both mental health and mental illness continuums should be considered when the overarching goal is to optimise mental health (Keyes et al., 2020).

Several scholars (e.g., Kuettel et al., 2021; Küttel & Larsen, 2019; Uphill et al., 2016) have argued that research in athletes has mainly focused on the mental illness (distress) continuum. Küttel and Larsen (2019) also note that research in athletes has tended to utilise the term “mental health” as synonym for the absence of symptoms of

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psychological disorders. These scholars (Kuettel et al., 2021; Küttel & Larsen, 2019; Uphill et al., 2016) also suggest that focus should be shifted from reducing mental illness, to promoting mental health in athletes. However, as shown in a review by Gouttebauge et al. (2019), publications on mental illness or distress in athletes have only recently begun to emerge (within the past 10 years) – suggesting that there is, in fact, relatively little empirical evidence concerning psychological disorders or distress in this population. Furthermore, when this critique is considered from a broader historical perspective, research within the field of sport psychology has traditionally been *more* focused on psychological skills, and optimal performance and functioning (i.e., mental health continuum), *rather* than psychological disorders or distress (i.e., mental illness continuum) (Moore & Bonagura, 2017). Hence, there is currently a substantial need for generating more empirical evidence on psychological disorders and distress in athletes, as this knowledge plays an essential role in mapping the potential barriers to overall mental health promotion (as suggested by the two-continua model). For example, Kuettel et al. (2021) found that while the absence of clinically significant anxiety symptoms did not automatically indicate optimal mental health (81.9% of those with minimal and only 17.8% with mild symptoms were identified as flourishing) – almost none of the athletes with moderate anxiety symptoms (.3%) and none of those with severe symptoms were identified as flourishing. Concerning depressive symptoms, 99.7% of flourishing athletes reported the absence of clinically significant depressive symptoms (none to only mild depressive symptoms), while almost no athletes (.3%) with moderate symptoms were identified as flourishing. Furthermore, of the athletes with severe depressive symptoms, none were identified as flourishing while 92.5% were identified as languishing. Based on these findings, experiencing even moderate levels of anxiety/depressive symptoms may significantly compromise athletes' mental health.

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While the Kuettel et al.'s (2021) findings highlight that the absence of clinically significant symptoms of psychological distress (e.g., depression or anxiety) does not necessarily mean that athletes automatically experience optimal mental health – they also highlight that experiencing psychological distress is a significant barrier to optimal mental health. As indicated by the findings in Kuettel et al.'s (2021) study, experiencing depressive symptoms may be especially debilitating for mental health in athletes (92.5% of languishing individual showed severe depressive symptoms while 55% of languishing athletes reported severe anxiety symptoms). Also, in previous research in which the mental illness continuum has been explored in relation to the mental health continuum, depressive symptoms have often been the main outcome variable (Keyes et al., 2002; Keyes et al., 2020) - suggesting that depression is central in understanding human suffering and distress.

Depression can be characterised as a chronic disturbance in individuals' cognitions (e.g., thoughts of worthlessness, death), mood (e.g., feeling sad or low), physical (e.g. sleep/psychomotor issues), and/or behavioural functioning (withdrawal from social contexts), and is therefore different from merely feeling sad or blue (Beck, 1967, 1976). Furthermore, different types of depressive symptoms may differentially impact on individuals' functioning across a broad area of different life domains. As shown by Fried and Nesse (2014), sad mood and concentration difficulties had the most severe influence on overall psychosocial functioning, insomnia had a strong effect on work life, self-blame on close relationships, and loss of interest on social activities. This suggests that an improved understanding of the risk factors and underlying mechanisms contributing to depression and its symptoms may be an essential piece of the puzzle when the overarching goal is to promote optimal mental health in athletes.

While significant strides have been made in the past decade to increase the research output on depressive symptoms in athletes (Gouttebarga et al., 2019), when

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compared to the research within general and clinical psychology, the literature-base is still in its infancy. There may be several reasons to why research in athletes has only recently begun to attract more scholarly attention. For example, depression in athletes may have seemed paradoxical as athletes are often perceived as (and/or expected to be) resilient, physically fit, and well-functioning individuals – characteristics that may seem at odds with vulnerability to depression (Peterson, 2009). Hence, there may have been a general assumption that athletes are rarely challenged by psychological issues that exceed their capacity to deal with these issues (Peterson, 2009). Considering that physical activity and participation in organised sports have also been linked with a wide range of positive health benefits (Eime et al., 2013), it is possible that researchers have been more inclined to explore depression in population groups less likely to benefit from these protective elements. Combining this with the traditional focus on performance enhancement within sports psychology could have contributed to an overall lack of scholarly attention to mental health issues such as depression in athletes. Indeed, much of the emerging research in the past decade seems to have had an undertone of having to convince different stakeholder communities that depression in athletes is ‘...more than just a media controversy’ (Frank et al., 2013, p.4) and that athletes ‘...are not somehow immune or resistant to depression’ (Wolanin et al., 2015, p. 59). Convincing stakeholders about athletes’ susceptibility to depression or depressive symptoms despite the potential protective factors that are linked to physical activity and participation in sports - has therefore been an essential first step to raising awareness of athletes’ susceptibility to depression and to stimulating more research in this population (Moesch et al., 2018).

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Prevalence of Depressive Symptoms in Athletes

Depression is one of the leading causes of non-fatal health loss in the world (James et al., 2018). An estimated 4-6 % of the world's population is currently living with depression (World Health Organization, 2017), and approximately 16% will meet criteria for a major depressive disorder during their lifetime (American Psychiatric Association, 2013). Although, studies have suggested that engaging in competitive sports may be a protective factor for depression (Armstrong et al., 2015) and overall psychosocial health (Eime et al., 2013), recent studies have suggested that prevalence rates in elite athletes may be similar to those reported in non-athletes (Gorczyński et al., 2017). However, as discussed by Gouttebauge et al. (2019) it has been difficult to make valid conclusions about differences between athletes and the general population, as to-date few comparative studies within athletes have included representative comparison groups from the general population.

Depressive symptom prevalence rates across athlete samples have also been highly variable, ranging from 6.7 % to 34.0% according to a recent review on prevalence rates in elite athletes (Golding et al., 2020). The prevalence rates in the North-American collegiate athlete population have shown to vary from 15.6% (Proctor & Boan-Lenzo, 2010) to considerably higher - for instance, Wolanin et al. (2016) reported that 21% of male and 28% of female collegiate athletes experienced clinically relevant depressive symptoms. Corresponding rates in college athletes were also reported for males (19.2%) and females (25.6%) by Yang et al. (2007). In the contexts of non-collegiate sport, Beable et al. (2017) reported a 21% prevalence rate in elite athletes in New Zealand, while Gulliver et al. (2015) found that 23.6% of male and 30.5% of female elite athletes in Australia reported clinically significant depressive symptoms. In Germany, Nixdorf et al. (2013) reported a 15% prevalence for professional athletes, 19% for junior professionals, and 29% for amateur athletes. In

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another study in Germany, Junge and Prinz (2018) found a 12.8 % prevalence rate of mild-moderate symptoms and 11.7% prevalence of severe depressive symptoms in female top-league football players. For players in the second-highest league, the corresponding prevalence rates were 25.4% for mild-moderate and 20.6% for severe symptoms of depression. In a study by Jensen et al. (2018) a 16.7% prevalence rate was found in Nordic male football players, with elite junior sample reporting a 28% and professional sample a 10% prevalence, and Tahtinen and Kristjansdottir (2019) reported a 20.9% prevalence in Icelandic individual sport athletes. These findings – from college and non-college sport contexts in various parts of the world suggest that experiencing clinically relevant levels of depressive symptoms is not uncommon in athletes. It should be, however, noted that, as discussed by Golding et al. (2020), in their review of 16 studies across different elite-athlete samples, studies explored different type of athletes and utilised different measures to estimate depressive symptom prevalence. Furthermore, even when studies utilised the same measure, prevalence rates were often reported using different cut-off scores for clinical relevance. This may partly explain the relatively high variability in prevalence rates across the reviewed studies.

Risk Factors to Elevated Depressive Symptoms in Athletes

Despite variations in depressive symptom prevalence rates across athlete samples, there seems to be an overall consensus that competitive athletes are a specific population that are confronted with both generic and (unique) sport-related stressors that may contribute to athlete depression and other mental health issues (Küttel & Larsen, 2019; Reardon et al., 2019; Wolanin et al., 2015). As mentioned by Schaal et al. (2011), while elite-athletes may exhibit similar rates of psychological disorders as the general population - psychological disorders in athletes may often be triggered by unique stressors embedded in the context of sports. For example, while more general life-stress

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has shown to increase risk for experiencing depressive symptoms in athletes (Beable et al., 2017), research has also identified a range of stressors that may be unique to athletes. These include stressors such as public evaluation of performance (Doherty et al., 2016), career transitions (Stambulova, 2017), and stressors that relate to challenges in adapting to different cultural contexts (Schinke, Blodgett, et al., 2018), the off-season, and post-competition (Doherty et al., 2016) and post-Olympic void (Howells & Lucassen, 2018). Furthermore, sport-specific stressors related to major negative life-events such as an athletic injury (Appaneal et al., 2009; Rice et al., 2018) or involuntary career termination (Wippert & Wippert, 2008) have shown to significantly increase risk for elevations in depressive symptoms in athletes.

In addition to contextual stressors, more stable, individual characteristics of the athletes have also shown to correlate with depressive symptoms in athletes. For example, in-line with findings in non-athlete samples (Breslau et al., 2017; Hankin et al., 1998) female athletes report overall higher depressive symptom rates than male athletes (Golding et al., 2020). Depressive symptoms may also vary depending on the athlete's level of competition. For example, there is evidence suggesting that lower level competitors exhibit higher levels of depressive symptoms than higher level competitors (Junge & Feddermann-Demont, 2016; Junge & Prinz, 2018; Nixdorf et al., 2013). However, these findings have to-date remained at a descriptive level – making it difficult to draw more elaborate and evidence-based conclusions about factors that explain these differences. Studies have for example shown that younger age is correlated with elevated depressive symptoms in athletes (Beable et al., 2017). Consequently, it is uncertain whether the observed difference between higher and lower-level athletes is due to the level of competition per se, or whether this relationship may be better explained by potential age-effects. Furthermore, rates of depression may also vary significantly *within* competition levels. In a sample of elite-level swimmers

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for example, Hammond et al. (2013) reported significant increases in rates of depression diagnoses among the top 25 % ranked swimmers following performance failure, while this was not observed among the bottom 75%. The authors implicated that these differences were likely due to a higher perceived significance of the athletic failure for athletes ranked in the top 25% when compared to those ranked in the bottom 75%. Again, however, factors that could potentially explain these differences have not been empirically tested.

Despite the descriptive nature of previous research, the findings from these studies suggest that the risk for experiencing elevated depressive symptoms may depend on the sport-specific context in which measurements are conducted (Rice et al., 2016). In support of this notion, individual sport athletes have shown to exhibit higher levels of depressive symptoms than team sport athletes (Beable et al., 2017; Nixdorf et al., 2016). Evidence is still scarce, however, and studies to-date have often consisted of a relatively small number of participants across different sports. Analyses have therefore tended to focus on comparisons across these broader categorisations of sport disciplines (i.e., team vs. individual), rather than differences across more specific sports. Hence, we do not know whether findings concerning differences between team sports and individual sports applies to all sports within these disciplines, or whether differences are mostly dependent on differences between a few specific sports. In one of the few studies that have compared specific sports in more detail, Schaal et al. (2011) found that female elite athletes competing in aesthetic sports (i.e. figure skating, synchronized swimming, and gymnastics) exhibited the highest rates of lifetime depression when compared to athletes from all other sport disciplines. In another study, Wolanin et al. (2016) reported the highest depressive symptom rates in female track and field athletes, when compared to male and female athletes from the other included sports. Hence, it is plausible that

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differences in susceptibility to depression across sports may be better explained by differences between specific sports, rather than the broader categorisations per se.

Although research is only beginning to understand how individual difference in athletes' depressive symptoms may emerge – the reviewed studies provide preliminary empirical evidence and insights into potential underlying factors. As reported by Nixdorf et al. (2016) junior athletes in individual sports showed to be more prone to experiencing depressive symptoms than team sport athletes. The authors found that these differences were explained by individual athletes' higher proneness to attribute performance failure to stable individual characteristics. As further discussed by the authors, athletes in individual sports are often held personally accountable for performance outcomes, whereas in team sports, outcomes are more often shared within the collective. Hence, individual sport athletes may differ in their interpretations of athletic failures, and this could potentially explain why some athletes, but not others experience higher depressive symptoms in response to athletic failure. The fact that Nixdorf and colleagues (2016) observed these differences in a sample of junior athletes ($M_{age}=14.96$), implicates that the underlying factors that contribute to individual differences in athlete depression may become established at a relatively young age. Hence, the developmental experienced gained through youth sports may be crucial for the cognitive development of the athlete and how they become to understand and respond to challenges in life (Mezulis et al., 2006).

It has been shown that athletes who compete in sports where specialisation (commitment to only one specific sport) occurs in childhood or early adolescence may be more likely to experience negative psychosocial outcomes when compared to athletes in sports where specialisation occurs later in adolescence (Côté & Vierimaa, 2014). One reason for these differences in developmental outcomes may be that in early specializing sport contexts where mastering of complex technical skills is more

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stringently emphasized, adult-style practices and high training volumes may be more common - potentially leading to an environment where young athletes are exposed to performance pressures from an early age (Myer et al., 2015). Considering that young athletes exposed to influences of the elite-environments may experience adult-like training regimes, coaching behaviours may also involve patterns that are unsuitable to the developmental level of the child. As noted by Gervis and Dunn (2004) athletes observed a shift in coaching behaviours and became more negative once athletes were identified as elite performers. Most athletes experienced belittling, shouting, threatening behavior, scapegoating, and humiliation as elite child athletes. The negative influence of performance environments on mental health outcomes may also depend on how performance is evaluated within the specific sport. As discussed by Schaal and colleagues (2011), when performance outcomes are determined by judge decisions (e.g. in figure skating or gymnastics) rather than by more objective criteria such as scoring goals, athletes may experience a loss of perceived control over performance outcomes. Long-term exposure to this type of evaluative environment during developmental years, could potentially lead to the development of dysfunctional attitudes (e.g. maladaptive perfectionism) and an overall sense of hopelessness (e.g. lack of control) (Mezulis et al., 2006; Schaal et al., 2011) - characteristics that have also been identified as central in cognitive vulnerability to depression (Abramson et al., 2002).

As the reviewed literature suggests, in the past decade much effort has been placed on building an improved understanding of the overall depressive symptom prevalence rates and related risk factors in athletes. Several risk factors have been identified consisting of demographic factors such as age, gender, type and level of sport, and events that are relatively inevitable in the context of competitive sports such as performance failure, career transitions, or injury. While previous research has contributed to the field by informing about potential in-risk athletes - far less attention

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has been placed on understanding *how* risk factors contribute to elevated depressive symptoms in some athletes (i.e., in-risk athletes), but not in others. This is a vital question as it may provide the key to an evidence-based understanding of the potential targets for prevention and treatment of depressive symptoms in athletes. As the reviewed athlete literature concerning difference between individual and team sport athletes, however, hints; differences in how athletes interpret negative events, may explain how stressors exert their effects on mental health outcomes in athletes. That is, when athletes consistently interpret negative life-events in a negative, or maladaptive manner, the likelihood of experiencing severe and chronic depressive symptoms increases (Abramson et al., 2002; Joormann & Arditte, 2015). In the next sections I will therefore review main concepts of cognitive vulnerability to depression, and how they may be relevant in the context of sports, and the current thesis.

Cognitive Vulnerability

Depression tends to emerge by mid-20s, but a large proportion of first-onset cases are observed even before the age of 20 (Hankin et al., 1998; Malhi & Mann, 2018). Lewinsohn, Rohde, and Seeley (1998) reported that 28 percent of adolescents had experienced an episode of Major Depressive Disorder by the age of 19 (35% of women and 19 % of men), and Hankin et al. (1998) found that the number of new depression cases increased during the ages 15 to 18, but decreased between ages 18 to 21. Hence, the development of vulnerabilities to depression may become established already in childhood or early adolescence (Mezulis et al., 2006; Shaw et al., 2019); a time that is also central in the development of the athletic craft (Côté & Vierimaa, 2014).

Individual differences in vulnerability to depression can be understood through the lens of cognitive vulnerability-stress (or diathesis-stress) theories of depression,

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which suggest that individual differences in depression depend on the interaction between cognitive vulnerability and negative or stressful life-events (Abramson et al., 2002). Hence, the core assumption is that individuals' cognitive makeup influences how life-events are interpreted, and hence, the same event may pose different meanings to different individuals, leading to different psychological outcomes (Abramson et al., 2002). Two major cognitive theories of depression, the cognitive theory (Beck, 1967) and the hopelessness model (Abramson et al., 1989) are based on the vulnerability-stress accounts of depression. Although these theories are conceptually similar, each theory identifies distinct vulnerabilities that are considered central in the development and maintenance of depression (Hankin, 2008; Joormann & Arditte, 2015). For example, as described by Abramson et al. (2002), Beck's cognitive theory identifies highly dysfunctional attitudes (e.g., maladaptive perfectionism) as the critical cognitive vulnerability to depression. According to this theory, dysfunctional attitudes interact with a salient stressor to trigger negative automatic thoughts about oneself, the world and the future, which in turn can lead to the onset of depression. In the hopelessness model, attributional or cognitive style is framed as the key concept in vulnerability to depression. Here, a vulnerable individual is more likely than the non-vulnerable individual to make internal (self-focused), stable (an enduring characteristic), and global (generalisable across contexts) inferences of an adverse event, subsequently leading to hopelessness (depression).

Another prominent cognitive vulnerability-stress theory in understanding individual differences in depression is the Response Styles Theory (RST: Nolen-Hoeksema, 1991). In the Response Styles Theory (Nolen-Hoeksema, 1991) and its subsequent revisions (Nolen-Hoeksema et al., 2008), depressive rumination is defined as a relatively stable cognitive vulnerability factor, which entails cognitive processes that emerge in response to sad or depressed mood. As proposed by Nolen-Hoeksema

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(1991), in individuals with a high tendency to ruminate, negative mood has a robust attentional valence which triggers thought processes about the negative mood, and the implications it may have for the individual. For example, in a vulnerable individual, distress or depressed mood may trigger a cascade of cognitive processes that focus solely on the distress - how sad, tired, and lonely one may feel. Consequently, increased cognitive attention to negative aspects of one's mood may also influence behavioural outcomes. For example, when a sad or negative mood is activated, a vulnerable individual may be unable to disengage from the thought processes that maintain the negative mood, and hence, the individual may choose to withdraw from social contexts to further dwell on their negative mood. Hence, in parallel to increasing attention to negative mood and its consequences, the consequent behavioural responses may interfere with other more constructive strategies that could potentially alleviate the negative state. Several empirical studies have provided evidence on the potential importance of depressive rumination, indicating that it has a central role in the onset (Just & Alloy, 1997; Nolen-Hoeksema, 2000), maintenance (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 1997; Spasojević & Alloy, 2001), and recurrence of depression and depression symptomology (Michalak et al., 2011).

Although ruminative responses to depressed mood are generally understood as maladaptive processes, they may also serve an adaptive function (Joormann et al., 2006). Indeed, focusing ones' thoughts on issues at hand may be adaptive in problem-solving, and self-reflection may contribute to an understanding of the self and the world (Watkins, 2016). This two-dimensional view of rumination as an adaptive and maladaptive process has been acknowledged in the continued refinement of the 22-item Ruminative Responses Scale (RRS), which was developed to measure depressive rumination. The original scale was criticised for including items highly similar in content to items in self-report measures of depression (Treyner et al., 2003).

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Subsequently, Treynor et al. (2003) removed items with depression-related content and conducted a principal component analysis on the 10 remaining items on the refined RRS. In these analyses, Treynor and colleagues identified two separate factors of depressive rumination: brooding and reflective pondering (reflection). In testing the relationship between these factors, Treynor et al. (2003) found that brooding was related to higher levels of depression concurrently and longitudinally. Although reflection was also related to more depression concurrently, it was associated with less depression over time. Lo et al. (2008) supported this finding, demonstrating that brooding, but not reflection, mediated the effects of negative attributional/cognitive style on depression. Consequently, reflective rumination has been characterised as goal-directed cognitive response style in response to negative mood, while brooding is characterised as a more passive (vs. active approach behaviours to dealing with issues at hand), abstract (vs. concrete problem solving), and evaluative (vs. accepting) processing style that focuses specifically on the symptoms, causes and implications of ones' negative mood (Treynor et al., 2003). Nevertheless, the role of reflection as a more adaptive trait is still uncertain and is likely to be dependent on individuals' tendency to brood as well as on their current levels of depression (Joormann et al., 2006).

While the cognitive-vulnerability models discussed in this section differ in the underlying variables hypothesised to explain the onset and maintenance of depression, a common thread is their shared understanding that vulnerable individuals have a relatively stable tendency to respond to stressors in a negatively biased, and self-focused manner (Ingram et al., 2006). The cognitive vulnerability theories are also not mutually exclusive, rather, the key vulnerabilities identified by each theory are likely to interact in the onset and maintenance of depression (Abramson et al., 2002; Hankin, 2008; Lo et al., 2008). However, while dysfunctional attitudes and negative cognitive styles may underlie the emergence of negative thought content (e.g. negative automatic thoughts)

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in response to a negative or stressful event, the key aspect that differentiates depressive rumination from other cognitive vulnerabilities discussed here, is that depressive rumination concerns the process by which negative affect (e.g., negative thought content) is further escalated and maintained (Hankin & Abramson, 2001; Nolen-Hoeksema, 1991). (Nolen-Hoeksema et al., 2008; Pearson et al., 2010). Depressive rumination can therefore be understood from a process perspective (e.g., attention), rather than by the specific contents of thoughts such as negative attributions or negative automatic thoughts (Joormann & Arditte, 2015; Nolen-Hoeksema, 2004).

Development of Ruminative Response Style

The development of a ruminative response style has shown to be linked with highly critical parenting styles (Spasojevic & Alloy, 2002), frequent negative reinforcement and punishment, and inconsistent and manipulative adult behaviours (Shaw et al., 2019). Also, a ruminative tendency may develop when individuals perceive that expression of thoughts and opinions are restricted (Watkins, 2016), and hence, rather than expressing concerns about thoughts and emotions with the immediate environment (e.g. parents), the individual may begin to engage in these dialogues internally. These developmental risk factors are believed to contribute to a generalised sense of helplessness in the face of adversity and distress, and consequently, children may develop a tendency to engage in passive and self-focused coping (Nolen-Hoeksema, 1991; Shaw et al., 2019). While ruminative responses to negative mood may be relatively common (state rumination) during childhood and early adolescence, some individuals may be less capable of disengaging from rumination, and may over time develop a more habitual tendency to ruminate (trait-rumination; Kashdan & Rottenberg, 2010; Shaw et al., 2019).

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As mentioned by Watkins and Nolen-Hoeksema (2014) although the original RST and previous empirical research has described depressive rumination as a habitual response to negative or depressed mood, the original RST does not explicitly elaborate on the process by which individuals would develop this habit (Ólafsson et al., 2020). In recent reforms of the RST, however, a habit-goal framework of depressive rumination extension to RST has been proposed by Watkins and Nolen-Hoeksema (2014). The habit-goal framework is an theoretically informed and empirically tested extension to the original response styles theory in which ideas from RST (depressive rumination as a stable trait) and control theories (rumination as a goal-oriented state) are merged to provide a more elaborate account of how depressive rumination (as described by the RST) may develop into a mental habit (Watkins & Nolen-Hoeksema, 2014). According to control theory accounts of rumination, a perceived goal-discrepancy (i.e. failure to reach a desired goal) triggers goal-oriented (intentional) state rumination, that is, repetitive thoughts focused on the discrepancy in one's goal progress towards desired goals (Papageorgiou & Wells, 2004; Watkins & Nolen-Hoeksema, 2014). If this state rumination consistently involves brooding qualities (abstract, passive, and evaluative) contingent on same or similar contexts (e.g. depressed/negative mood) it may over time develop into a habitual trait (Watkins & Nolen-Hoeksema, 2014). However, if an individual also utilise different, more adaptive approaches to resolve their goal-discrepancy (e.g. rumination more reflective and goal-oriented leading to more constructive and concrete action-oriented responses), rumination may not develop into a habitual response. Hence, this theoretical elaboration can better explain why individuals may sometimes engage in maladaptive (brooding) rumination in response to negative life events, without necessarily developing a habit of depressive rumination (Watkins & Nolen-Hoeksema, 2014). In a recent study by Ólafsson et al. (2020), depressive rumination was experimentally tested from the perspective of the habit-goal framework

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of depressive rumination. Ólafsson and colleagues (2020) found that brooding, but not reflective, rumination was associated with greater automaticity and a lack of conscious control. As discussed by the authors, brooding processes may hence represent these habitual responses to salient stimuli, which primes further negative affect before more adaptive goal-oriented responses can be generated. This is in line with previous findings which suggests that brooding, but not reflective rumination predicts depression over time (Treyner et al., 2003). Although trait or habitual rumination remains relatively stable over time, like other cognitive vulnerabilities, depressive rumination is amenable to change through therapy or intervention (Ingram et al., 2006). Indeed, sport psychology scholars have recently voiced the need for more research on cognitive vulnerability in athletes to better understand individual differences in athlete depression and hence, to develop more targeted prevention and intervention within this population (Elbe & Jensen, 2016; Nixdorf et al., 2016, 2020).

Depressive Rumination in the Context of Sports

An impaired ability to disengage from negative stimuli (e.g. negative mood) is the key component by which depressive rumination increase vulnerability to depression (Koster et al., 2011). This may be especially relevant in terms of brooding rumination which may be driven by automatic, rather than goal-directed, attentional processes (Koster et al., 2011). In a similar vein, attentional processes are the key to understanding psychological states that underlie optimal athletic performance. Recently, a model of optimal performance was introduced by Swann et al. (2017). In this model the key states for optimal performance are identified as flow and clutch states. According to the model by Swann and colleagues (2017), a flow state is characterized as a state of calmness, absence of critical or evaluative thoughts, and moments during athletic performance where the athlete experiences fully automated skill execution and

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effortless attention on the task at hand. A clutch state is similar in the way that there is an absence of negative thoughts and skills are executed automatically, however, attention is more deliberate, and the athlete applies intense effort to their skill execution. Furthermore, while flow may be a rarer occurrence, clutch states may be experienced more frequently during an athletic performance (Swann et al., 2017). The key element of optimal performance according to this model hence lies heavily on the athletes' ability to experience (flow) and to apply (clutch) attention on the performance task in accordance with the situational demands. Considering the centrality of attentional processes in optimal performance states as well as in the onset and maintenance of depression – exploring depressive rumination as a vulnerability factor to depressive symptoms in athletes is highly relevant.

Of the few studies that have empirically tested rumination in athletes suggests that rumination may be linked to unbeneficial performance outcomes. For example, Bennett et al. (2016) found that higher levels of rumination was related to type 1 yips and lost movement syndrome (disruptions in specific movement patterns or involuntary bodily movements/sensations). As the authors discuss, this relationship could be explained by the underlying intrusive thought patterns in rumination that emerge in response to a negative performance outcome (Bennett et al., 2016). That is, with the activation of rumination in response to a relevant cue (e.g., athletic failure), attention is directed to cognitive (ruminative) processes which impairs automated skill execution (Bennett et al., 2016). Hence, a breakdown in athletic skill execution or performance may activate ruminative processes which over time may escalate to a recurring and potentially career-ending disruptive cycle (Bennett et al., 2016). Furthermore, in two studies by Roy et al. (2016), brooding and reflective rumination tendencies were explored first in male football players and then in female field hockey players in comparison to non-athletes. Their results showed that reflective rumination decreased as

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skill level increased, but no significant differences were found in brooding rumination between the male football players and non-athletes. Low ruminative brooding was, however, correlated with longer professional athletic careers. In the female sample, field hockey players had significantly lower brooding and reflective rumination than female non-athletes. In sum, although limited in scope, there is some evidence that suggests that increased tendency to engage in depressive rumination may be linked to less beneficial sport-related outcomes (e.g. lower skill level, disruptions in skill execution, attenuated career length).

Considering that the pursuit of optimal performance is central to competitive sports, the performance of the athlete may not only influence the athlete themselves but also others that are highly invested in the athlete's performance (e.g. coaches, parents) (Gervis & Dunn, 2004). Consequently, in some competitive sport contexts athletes may be in an increased risk for being subjected to harmful behaviours from authority figures. For example, athletes may be subjected to manipulation or verbal abuse, excessive personal control or dismissal of athlete individuality and autonomy (Bartholomew et al., 2009). In these highly competitive sports environments, harmful behaviours may often be masked under the performance narrative and may become normalised as part of the "pathway-to-excellence" and "win-at-all-cost" discourse (Jacobs et al., 2017; Mountjoy, 2020). Considering the time and effort that goes into developing an athletic craft, and that athletes may spend a considerable amount of their childhood and adolescence years in the sporting environment – these contextual influences may have special significance for the psychological development of the athlete (Strachan et al., 2011). Furthermore, if athletes are systematically exposed to harmful behaviours at a young age, the long-term effects on the psychological development of the child may be detrimental (Gervis & Dunn, 2004). As described in a study by Gervis and Dunn (2004), an athlete described how coach behaviours had a lasting influence on their psychological development:

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I gave up because I had no confidence, because she constantly told me that I was crap and worthless all the time. I believed this and it carried on into general life and I am now scared of rejection, failure, because of the things she did. (Gervis & Dunn, 2004, p.221)

Considering the developmental antecedents in depressive rumination discussed in the previous section, if an athletic environment consistently discourages expression of thoughts and opinions (e.g., perceived as a weakness by authority figures), or consistently exposes young athletes to critical and punishing adult behaviours - athletes may be more likely to engage in internal dialogues to deal with the consequent negative mood (Watkins, 2016). If the athlete consistently engages in rumination in response to negative mood, this behaviour could develop into a ruminative habit over time (Watkins & Nolen-Hoeksema, 2014). For example, when athletes are faced with difficult experiences that elicit negative mood (e.g. when experiencing pain when injured, making a mistake, feeling anxious under pressure) but cannot constructively deal with these issues (e.g. seek support/advice), ruminative habits may develop as a coping mechanism (Nolen-Hoeksema, 1991; Shaw et al., 2019). These negative experiences may then also become internalized as a core fault in one's character, rather than as a normal response to a challenging situation (Mezulis et al., 2006; Nixdorf et al., 2016; Uphill & Dray, 2009). Rumination also involves a repetitive and evaluative approach to thinking about oneself in relation to others and the discrepancy between current and desired state (Watkins, 2016). Considering that athletes are likely to set high standards for achievement, often in comparison to others, athletes could be especially prone to experiencing goal-discrepancies. If these situations are systematically imposed on young athletes who have not yet developed adaptive coping skills, there is a risk that

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rumination may develop into a default mode of coping in response to goal-discrepancies/negative mood. Considering that the competitive sport environment may also be unique in the way that it may expose individuals regularly to events that elicit mood fluctuations (Jones & Sheffield, 2007) - athletes who develop a habitual ruminative response style in response to negative mood may be in a significant risk for experiencing more severe levels of distress.

In sum, considering that depressive rumination is linked to increased risk for depression and to disruptions in athletic performance – exploring depressive rumination in athletes is highly relevant as it may provide avenues for targeting both mental health and performance outcomes. As shown in a study by Donohue et al. (2018) this type of approach to treatment or prevention may be highly appealing to athletes, potentially leading to higher engagement in the program. For example, Donohue and colleagues (2018) showed that a treatment program that addressed both performance and mental health-related issues in university athletes, showed better athlete engagement in the intervention compared to a traditional non-sport-specific counselling program. Furthermore, their study showed more beneficial mental health and substance use outcomes in athletes in the sport-specific program when compared to on-campus counselling. Exploring depressive rumination in athletes is also highly relevant considering that in some sport contexts, the landscape for developing depressive rumination into habitual trait may be especially fruitful. When also considering that the response styles theory predicts that “high ruminators” tend to dwell on their negative thoughts and emotions, leading to more severe and recurrent distress, athletes who develop a tendency to ruminate may be an especially significant risk group for experiencing depressive symptoms. Although rumination has been previously highlighted as an important vulnerability factor in the athlete mental health literature

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(Uphill & Dray, 2009), and often appears in texts when research findings are discussed - rumination itself has rarely been tested empirically in athletes (Kröhler & Berti, 2019).

CHAPTER 2: Definitions, structure, and aims of the thesis

Definitions

Definition of “athlete”

To understand the athlete population in terms of susceptibility to depression or to experiencing depressive symptoms, it is important to define the term “athlete”. The word “athlete” is derived from the Greek words “athlos” (contest), “Athlon” (prize), and “athlein” (to contend for a prize), suggesting that the inherent part of being an athlete involves competition (Chelladurai, 2007; Kyle, 2013). McKinney et al. (2019) utilise this original translation to make the distinction between athletes and exercises, where the intent of the physical engagement determines whether an individual can be identified as an athlete or not. Hence, according to McKinney et al. (2019), the first defining feature of an athlete consists of engaging in “contest” or competition in sport. Athletes can furthermore be categorised depending on the frequency of training and level of competition. McKinney et al. (2019) categorise athletes into recreational, competitive, and elite athletes. Nevertheless, there exists large variations between studies on how to define specific athlete groups such as elite athletes. For example, Swann et al. (2015) showed that definitions of elite athletes have ranged from Olympic athletes to athletes competing at the regional levels. Swann and colleagues also suggested that when making the distinction between elite and non-elite athletes, specific criteria such as the individual’s highest level of competition and success, and the popularity of the sport within the country and worldwide, should be taken into consideration. In this thesis, however, the term athlete is used in a broader sense, including any type of individual who is currently active in competing in a sport, while also specifically identifying other relevant characteristics (e.g. former professional athlete) when necessary.

Assessment of Depression

As defined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), major depressive disorder (MDD, also referred to as clinical depression) is defined as consisting of nine potential symptoms; depressed mood, decreased interest or pleasure (anhedonia), changes in weight or appetite, problems with sleep, psychomotor agitation or retardation, fatigue/loss of energy, worthlessness/guilt, problems with concentration, and thoughts of death. Structured or semi-structured clinical interviews are used to diagnose MDD, and at least five out of the nine depressive symptoms listed in DSM-5 must be present for a diagnosis, of which at least one must include depressed mood and/or decreased interest/pleasure (American Psychiatric Association, 2013). As MDD consists of a certain number of symptoms (i.e. five or more) rather than a specific combination of symptoms (Ingram et al., 2015), the symptom presentation across individuals with the same MDD diagnosis can be highly heterogeneous (individuals exhibit different type of symptoms; Zimmerman et al., 2015). In fact, there are "...roughly 1,000 unique combinations of symptoms that all qualify for a diagnosis of MDD, some of which do not share a single symptom" (Fried & Nesse, 2015, p.2).

Symptoms of MDD or depression can also be assessed via self-report questionnaires in which symptom severity (rather than formal diagnosis) is the primary outcome measure (Fried & Nesse, 2015; Ingram et al., 2015). Questionnaires can vary in terms of their assessment period (e.g. symptoms present the past week or past two weeks), and number and type of symptoms assessed. For example, the Center for Epidemiologic Studies Depression Scale is based on DSM criteria but also includes positive affect items with a total of 20 items, and assesses symptoms in the past week (CES-D, Radloff, 1977). Another commonly utilised self-report measure, the nine-item Patient Health Questionnaire (PHQ-9, Kroenke & Spitzer, 2002), is specifically

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designed to assess the nine DSM symptom criteria, assessing symptom frequency within the past two weeks. Despite the different structure of questionnaires or screening tools, a common feature is that the overall symptom severity is calculated by summing scores from individual symptom items, and specified cut-off points are then imposed to indicate whether or not total scores reach severity levels that may call for intervention or further assessment (Dozois et al., 1998; Kroenke & Spitzer, 2002; Radloff, 1977). However, the core symptoms of depression (i.e. depressed mood or anhedonia/lack of interest), of which at least one is required to be present when determining diagnosis via clinical interviews, do not need to be present when questionnaires are used to assess the clinical significance of symptoms (Fried et al., 2016). Also, there are no criteria for the minimum number of symptoms when assessing the clinical significance of symptoms. Consequently, the symptom heterogeneity discussed concerning MDD is further escalated when depression is operationalised in terms of summed symptom scores (Fried et al., 2016).

There may, therefore, be a disadvantage in interpreting questionnaire data solely concerning sum-scores, as these scores may mask important information of the underlying symptomology (Fried et al., 2014; Ingram et al., 2015; Moriarity & Alloy, 2020). Consequently, if the interpretation of findings are solely based on sum-scores, research conclusions could in some cases turn out to be "...as inadequate as the count of broken bones in a trauma victim" (Fried & Nesse, 2015a, pp., 6-7). This is, however, not to mean that sum-scores should not be applied or that they are not meaningful in research, but rather, that there may be several opportunities over and beyond sum-scores that symptom-based assessment could offer.

In this thesis, the terms "MDD" or "clinical depression" are utilised when referring specifically to research that has assessed clinical depression via diagnostic interviews, and 'depressive symptoms' when specifically referring to research that has

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assessed depressive symptoms via questionnaires. When referring to individual studies that may have used both methodologies or when discussing collectively several research studies (in which specifying each assessment method is not possible) the term ‘depression’ will be used to refer more generally to clinical and/or subclinical depression.

Structure, Impact, and Aims of the Thesis

This thesis is built upon four empirical studies that explore different, but related aspects concerning depressive symptoms in athletes. Following each empirical study, a short overview, “The bridge”, will be provided to underline the rationale for each study within the thesis. The overall aim of this thesis is to promote further knowledge advancement on depressive symptoms within the field of sport psychology in terms of awareness of gaps in the literature, current issues relating to measurement of depressive symptoms in athletes, and the role of cognitive vulnerability in the likelihood of experiencing depressive symptoms in this population. Based on the findings of this thesis, practical implications of the findings will also be discussed.

Study 1

Study one serves as a basis for identifying important gaps in current literature base. Considering that there is still a paucity of research within the field, the aim of the first study is to scope the broader methodological trends across previous empirical studies and to systematically identify the topics that have (and not) received scholarly attention concerning depressive symptoms in athletes. While study one will serve as a basis for guiding the focus of the subsequent empirical studies in the current PhD, it also aims to fill gaps that have been left uncovered by previous reviews in the field. For example, as previous reviews have focused on relatively specific topics, several primary

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studies that have emerged within recent years have not been included in these reviews. Therefore, study one aimed to utilise broader inclusion criteria than previous reviews, to provide a more comprehensive perspective on the research output concerning depressive symptoms research in athletes. Study one is expected to have an important impact on the field in terms of increased awareness of the current-state of the empirical knowledge-base and provides a systematic road map for addressing gaps in future studies. The aim of the study was to;

1. systematically identify the methodological characteristics of the research that has assessed depressive symptoms in athletes.
2. Systematically map the variables/topics that have been directly tested (statistically) in relation to depressive symptoms and to calculate the overall frequency by which each topic has emerged in previous studies.

Study 2

The second study aims to explore depressive symptoms prevalence in a large representative sample of Icelandic athletes. While study two improves previous research by utilising a large sample to provide more representative rates of depressive symptoms in Icelandic adult athletes – it also addresses issues related to the assessment of depressive symptoms. More specifically, study two explores the symptom profiles of athletes who exhibit clinically significant depressive symptoms based on cut-off scores and explores the prevalence of specific depressive symptomology. The findings from this study are expected to have major impact on depression-related research in athletes, as issues relating to measurement are fundamental in the interpretation and dissemination of research findings. The specific aims of study two were to;

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1. explore the overall prevalence rates of depressive symptoms and compare these across age, sex, type of team sport, and level of competition.
2. explore the prevalence of the core symptoms of depression (i.e., depressed mood and lack of interest/pleasure) across different sum-score severity, and to identify the number of additional symptoms exhibited by athletes with or without these core symptoms.
3. test potential differences in athletes' the likelihood of exhibiting specific depressive symptoms across age, sex, type of team sport, and level of competition.

Study 3

The third study aims to improve previous research within and outside this thesis by implementing a theory-driven approach to exploring individual differences in vulnerability to depressive symptoms in athletes. Vulnerability to depressive symptomology is explored through the lens ruminative response styles theory which assumes that individual differences in depressive rumination serves as the underlying mechanism by which negative mood translates into more severe distress. Previous research has been largely atheoretical and descriptive, and hence, theoretically informed studies concerning factors that could potentially explain how risk factors exert their effects on individual differences in depressive symptoms are needed. This would inform of potential factors that could be targeted directly through prevention or intervention initiatives. Cognitive vulnerabilities such as depressive rumination are often the core targets in clinical practice, and hence, knowledge advancement concerning cognitive mechanisms in athletes is vital. Therefore, testing the relationship between depressive rumination and depressive symptoms in athletes not only validates findings from clinical psychology research in the included athlete sample, but also serves as a

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steppingstone for an improved understanding of individual differences in athlete depression. The aim of study three was to;

1. report prevalence of clinically relevant depressive symptoms and specific symptoms in the sample.
2. explore potential differences in depressive symptoms and depressive rumination scores (brooding and reflection) across athlete characteristics.
3. to test whether athletes with different types of brooding and reflection (vulnerability) profiles would differ in rates of clinically relevant depressive symptoms.

Study 4

The fourth and final study aims to build upon study three by testing the ruminative response styles theory utilizing a three-wave longitudinal study spanning a 12-month period. The lack of longitudinal investigations to advance knowledge concerning the temporal relations between depressive symptoms and risk factors has been identified as one of the main gaps within the field. Study four hence aims to contribute to current gaps in the literature, while also expanding theoretically informed knowledge on potential individual vulnerability that may serve as an important target in future applied work within athletes. While study three provided preliminary evidence on the relationship between depressive rumination and depressive symptoms in athletes across a wide range of different competition levels in the UK, study four focuses specifically on athletes competing at the highest level in Iceland. Furthermore, study four aims to conduct a more fine-grained analysis of the response styles theory using a longitudinal research design. More specifically, study four explores the interaction effect between depressive rumination and individual fluctuations in perceived stress on athletes' depressive symptoms. This final study is expected to be a vital addition to the

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current knowledge base as it provides a more dynamic understanding on how underlying vulnerability (depressive rumination) can predict and explain individual differences in depressive symptoms over time. The specific aim of study four was to;

1. explore prevalence rates of clinically significant (sum-score) and specific depressive symptoms.
2. test whether perceived stress over the study period (fluctuations around athletes' average score) contributes to differences in depressive symptoms over time (measured at each time point).
3. explore whether brooding and reflective rumination predicted differences in depressive symptoms over time.
4. test whether between-athlete differences in the tendency to brood and/or reflect at the beginning of the study moderated the potential prospective relationship between stress and depressive symptoms.

CHAPTER 3: Empirical Research

Study 1: Scoping Review of Depressive Symptoms Research

Study 1 - The Bridge

The first empirical study in this thesis is a comprehensive review of the athlete depression-related literature. As the first chapter of this thesis already suggested, there have been several reviews on depression in athletes. However, previous reviews have been relatively specific in terms of their aims and the corresponding inclusion and exclusion criteria. They may therefore not be representative of the overall scholarly work conducted within the field. Therefore, a comprehensive scoping review was conducted in which the methodological characteristics of previous studies were systematically identified. Perhaps the most novel aspect of the review was, however, the mapping of the topic areas that have been at the forefront of the emerging evidence-base. Previous reviews have not conducted such a comprehensive review of studies specifically in terms of the topics and variables that have been explicitly tested in relation to depressive symptoms. Hence, this review provides a novel perspective of the potential gaps in empirical-evidence, and hence – will be an important source for guiding this thesis in its attempt to further explore novel questions and to generate new knowledge.

**Gaining Perspectives: A Scoping Review of Research Assessing Depressive
Symptoms in Athletes**

Although research on mental health issues in athletes dates back as far as the late 80's (Nudelman et al., 1988), it is not until recently that literature reviews on the topic have emerged (Armstrong et al., 2015; Frank et al., 2015; Gorczynski et al., 2017; Gouttebauge et al., 2019; Rice et al., 2016; Wolanin et al., 2015). This suggests that research on athlete mental health has only recently begun to emerge within the field of sports psychology. For example, in a review by Gouttebauge et al. (2019) 32 of the 34 included studies were published after the year 2010. Several previous reviews have improved the understanding of different depression-related topics in athletes, such as prevalence rates and risk factors (Frank et al., 2013; Golding et al., 2020; Wolanin et al., 2015) and differences between athletes and non-athletes (Armstrong et al., 2015; Gorczynski et al., 2017). Some research has also provided valuable information concerning the measurement of depressive symptoms in athletes. As identified in a review by Golding et al. (2020), several measures and cut-off scores have been utilised when assessing and reporting prevalence rates in athletes. However, as Golding et al. (2020) review included only 16 studies that reported prevalence rates, findings from their review may not be representative of the overall trends within the field. Other reviews to date have also been limited in their breadth of scope in terms of the type of included studies. For example, one systematic review included merely comparative studies, with samples consisting of student-athletes and non-athletes with ≥ 100 participants (N=10; Armstrong et al., 2015), one study included only elite-athletes (N=10; Frank et al., 2015), and in a more recent meta-analysis, only comparative studies reporting prevalence rates for high-level athletes and non-athletes were included (N=5; Gorczynski et al., 2017).

Study 1: Scoping Review of Depressive Symptoms Research

Considering the aims and the corresponding inclusion/exclusion criteria of previous reviews, and the increasing research output on athlete mental health issues in the past decade (Gouttebarga et al., 2019), it is likely that several studies have not been included in previous reviews. A comprehensive review of the research output within this emerging field, especially in terms of the methodological characteristics, and the variables that have been tested in relation to depressive symptomology in athletes, is thus essential. This type of review would not only allow for an increased understanding of the methodological approaches utilised across various athlete samples - but also provide a map of the correlating variables that have, and have not, received scholarly attention in depression-related research in athletes. Although there have been some reviews that have scoped the broader trends in the emerging literature (Gouttebarga et al., 2019; Küttel & Larsen, 2019), these have focused on a range of different mental health issues, limiting their depth of information concerning research on depressive symptoms.

The current review

A diagnostic interview is the gold standard for the assessment and diagnosis of clinical depression (MDD), while depression questionnaires are utilised to assess level and severity of depressive symptoms (Ingram et al., 2015). It has been noted that most studies in athletes have utilised questionnaires to assess depression and that more research on MDD in athletes is needed (Golding et al., 2020; Gorczynski et al., 2017). However, it is likely that the challenges with cost and time, as well as the availability of qualified clinicians for conducting clinical interviews, will continue to influence the choice of utilising questionnaires over diagnostic interviews in research. Depressive symptoms in themselves can also be a significant source of distress and impairment and have been linked with an increased risk for developing MDD (Ingram et al., 2015).

Study 1: Scoping Review of Depressive Symptoms Research

Indeed, the study of depressive symptomology has been highlighted as an important area of research in athletes (Reardon et al., 2019). Considering that it is likely that research will continue to utilise screening instruments to assess depressive symptoms in athlete research, it is important that the methodological gaps and issues in this type of research are systematically evaluated. Hence, in this review the focus is explicitly on research that has utilised self-report measures to assess depressive symptoms in athletes.

Individual differences in depression can be understood from a cognitive vulnerability perspective - individuals differ in their thoughts, inferences, attitudes, attention, and memory processes - laying the foundation by which individuals differ in their responses to stressors (e.g. negative life-events; Joormann & Arditte, 2015). Cognitive vulnerability theories posit that vulnerable individuals are more likely to engage in maladaptive thought processes (e.g. rumination) in response to adverse events, and are therefore at an increased risk of developing depression (Abramson et al., 2002; Joormann & Arditte, 2015). Within the clinical psychology domain, Hankin (2012), however, underlined the importance of considering the development of depression from a multi-level perspective (Hankin, 2012). Similar ideas have recently been echoed in the sport psychology domain, calling for a broader, multi-level approach to understanding mental health in athletes (Purcell et al., 2019). Hankin (2012) proposed a conceptual model (Figure 1) in which the interaction between several factors at multiple levels are considered important in the development of depression. The conceptual model identifies different levels as; within-person vulnerabilities (e.g. genes, physiology, cognitive vulnerabilities), social and interpersonal influences within the proximal environmental contexts (micro- and meso-level factors), and influences emanating from the broader socio-cultural contexts (i.e. macro-level influences). This model provides a comprehensive view of depression and was hence considered optimal in providing an empirically informed basis for for visually illustrating the different

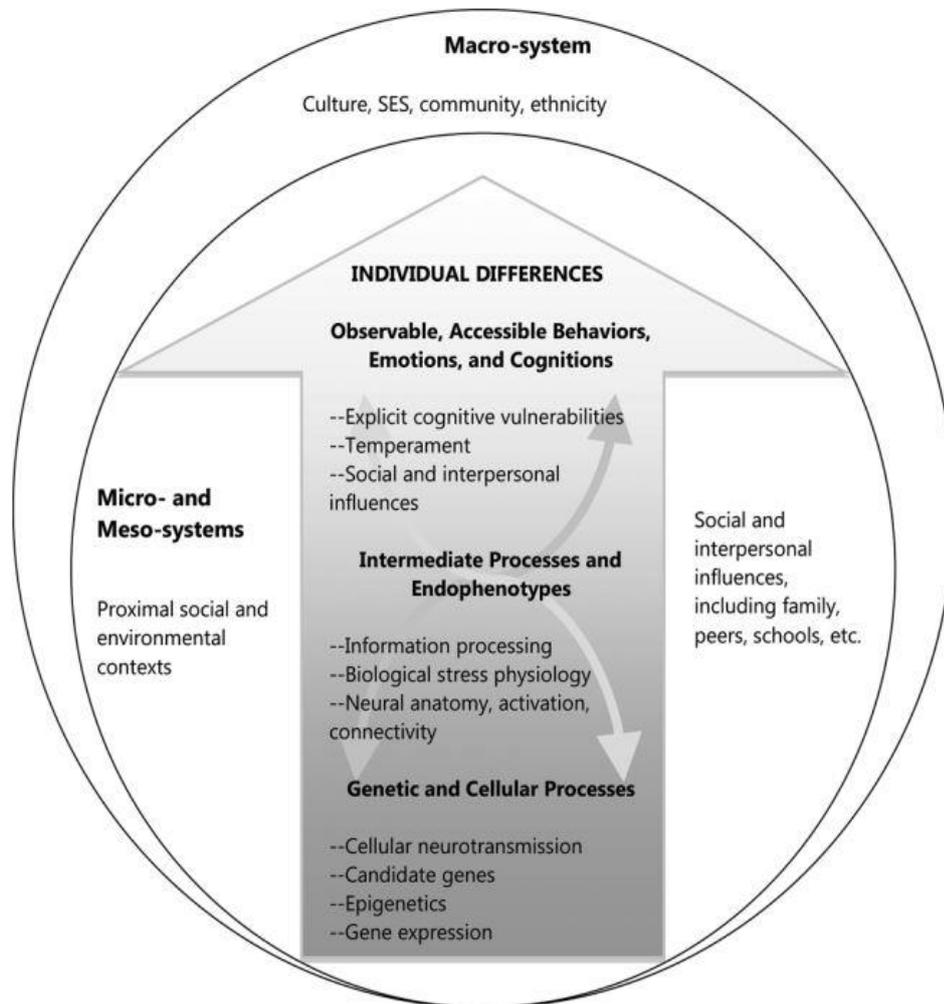
Study 1: Scoping Review of Depressive Symptoms Research

variables/topics that research has tested in relation to depressive symptoms in athletes. The micro-and meso-level were considered as determinants within different settings or as the interaction across settings (e.g. educational, athletic, home etc.), including different psychosocial and physical determinants that may influence depressive symptoms in athletes. These levels also include the within-athlete determinants (e.g. observable behaviours and cognitions) illustrated separately within the centred arrow (Figure 1). Macro-level variables were considered as non-physical such as cultural or religious belief systems (Bronfenbrenner, 1979). How variables were expected to exert their influence on depressive symptoms determined in which levels variables were categorised. Nevertheless, it should be noted that several variables could exert their effects on depressive symptoms at multiple levels. As an example, sex could be expected to influence depressive symptoms at the individual level (biological mechanisms) the micro-and meso levels (developmental experiences) or at the macro level (cultural beliefs). Hence, the categorisation should be interpreted with this notion in mind.

Study 1: Scoping Review of Depressive Symptoms Research

Figure 1

Conceptual multilevel analysis model of depression proposed by Hankin (2012)



In sum, the first aim of this scoping review was to systematically identify the methodological characteristics of the research that has assessed depressive symptoms in athletes. The second aim was to identify the variables/topics that have been directly tested (statistically) in relation to these symptoms. By taking this approach, this review aims to fill an important gap that has been left uncovered by previous reviews in the field.

Study 1: Scoping Review of Depressive Symptoms Research

Methods

A scoping review is often utilised when the emerging literature has not been reviewed comprehensively (Peterson et al., 2017), hence, this methodological approach was deemed the most appropriate for conducting the current review. A scoping review is especially useful when the aim is to identify how research has been conducted, the factors that relate to the concept of interest, and the gaps that exist in the empirical knowledge base (Munn et al., 2018). As the focus of this review is not to collate empirical evidence from a narrowly defined research topic (Munn et al., 2018), a risk of bias or quality appraisal of the included studies was not conducted (Tricco et al., 2018). However, by exploring the methodological and sample characteristics (e.g., assessment tools, type of sport or sex of the athletes across a range of studies) and what the research has focused on (e.g., concussion and depressive symptoms), findings from this review can inform future research of the methodological issues that may warrant further attention (Daudt et al., 2013).

The review process was guided by the framework proposed by Arksey and O'Malley (2005), which includes five distinct stages - 1) identifying the research question; 2) identifying relevant studies; 3) study selection; 4) charting the data; 5) collating, summarising, and reporting the results.

Identifying the Research Question

The broader research question of this review was formulated as follows - 'what are the characteristics of the studies that have assessed depressive symptoms in athletes and what type of variables have been tested in relation to these symptoms? The specific objectives related to these research questions were to: 1) identify the overall publication trends including the number of primary studies by year and country, 2) identify study

Study 1: Scoping Review of Depressive Symptoms Research

methodology and instrumentation, 3) identify sample characteristics, and 4) identify the variables/topics that have been explicitly measured concerning depressive symptoms.

Identifying relevant studies

Initial searches were conducted between September 2018 and February 2019. Considering that depression and depressive symptoms have often been used interchangeably in the athlete literature (Schuch, 2015), the search strategy was to allow for the inclusion of both these terms. Initially, the search term ‘Depress* AND athlete*’ was utilised across all the databases, including grey literature (Table 1). Following the initial search, more specified Boolean search terms in the following databases were applied; Medline, PubMed, SportDiscuss, and Cinahl (Table 1). Finally, hand searches were conducted in key articles’ reference lists, and seven different sport psychology journals (Table 1). All search results were exported to a referencing software (Zotero) and then to a systematic review software (DistillerSR, Evidence Partners, Ottawa, Canada). DistillerSR systematic review software version 2.27.0 was used for removing duplicate records, and for the screening and extraction of articles for the review. All searches were repeated in September 2019 to search for additional research published between September 2018 and September 2019.

Study 1: Scoping Review of Depressive Symptoms Research

Table 1

Database and journal search strategy

Database/Journal	Search terms
Ebscohost	
Academic Search Complete	Depress* AND Athlete*
CINAHL Plus with Full Text	Depress* AND Athlete*
Education Research Complete	Depress* AND Athlete*
ERIC	Depress* AND Athlete*
Medline	Depress* AND Athlete*
OpenDissertations	Depress* AND Athlete*
SportDiscus with Full Text	Depress* AND Athlete*
Proquest	
PsychArticles	Depress* AND Athlete*
PsychInfo	Depress* AND Athlete*
OpenGrey	Depress* AND Athlete*
Science Direct	Depress* AND Athlete*
Google Scholar	Depress* AND Athlete*
PubMed	Depress* AND Athlete*
SportDiscus full text	(DE "MENTAL depression" OR DE "MENTAL health" OR DE "MENTAL health of athletes" OR DE "MENTAL illness") AND (DE "ATHLETES" OR DE "SPORTS")
Medline	(MM "Depression" OR MM "Mental Health" OR MM "Mental Disorders") AND (MM "Athletes" OR MM "Sports")
CINAHL plus full text	(MM "Depression" OR MM "Mental Health" OR MM "Mental Disorders") AND (MM "Athletes" OR MM "SPORTS")
PubMed	("Depression"[Mesh] OR "Depressive Disorder"[Mesh] OR "Depressive Disorder, Major"[Mesh]) AND "Athletes"[Mesh]
Journal of Clinical Sport Psychology	Depress*
International Journal of Sport and Exercise Psychology	Depress* AND Athlete*
Journal of Applied Sport Psychology	Depress* AND Athlete*
Journal of Sport Psychology in Action	Depress* AND Athlete*
Psychology of Sport and Exercise	Depress* AND Athlete*
Sport, Exercise, and Performance Psychology	Depress* AND Athlete*
The Sport Psychologist	Depress*

Study 1: Scoping Review of Depressive Symptoms Research

Study selection

The following inclusion criteria for articles were set: 1) primary research utilising depression questionnaires to assess depressive symptoms; 2) any design such as cross-sectional, longitudinal, or intervention design; 2) sample defined as non-disabled or disabled athletes or competitors in a sport (current or former) including any competition level such as professional, Olympic, elite, national, international, or regional, or student-athletes; 3) all ages; and 5) manuscripts or abstracts written in the English language.

The following exclusion criteria were set: 1) secondary data (e.g. reviews or commentaries), 2) studies not identifying participants as athletes or competitors in a sport, 3) sample defined merely as participants engaging in physical activity, 4) no depression questionnaire or measures assessing merely mood or affect, and 5) measures that produce a global score without explicitly referring to depressive symptoms.

Based on the final inclusion/exclusion criteria, each article identified by the search was screened for title by the PhD candidate (RT). Articles that were included or articles that needed further screening based on the title advanced to the abstract and full-text screening stage. RT conducted all screening and extraction procedures; however, an integrity check was conducted at the level of abstract and full text screening on 20% (n=136) of the articles by the main PhD supervisor (RM). Of these randomly selected records, RT and RM agreed on the inclusion of 29 records and exclusion of 96, and hence, the overall proportional agreement was 92% $[(29+96)/136]$. None of the studies initially included by RT was excluded; however, one study that was initially excluded by RT (Donohue et al., 2015) was included after the integrity check by RM.

Following the screening process, RT extracted information from all the included studies. An external collaborator (JS) utilised the same extraction sheet as RT to independently extract information on 31 (20%) randomly selected studies. No

Study 1: Scoping Review of Depressive Symptoms Research

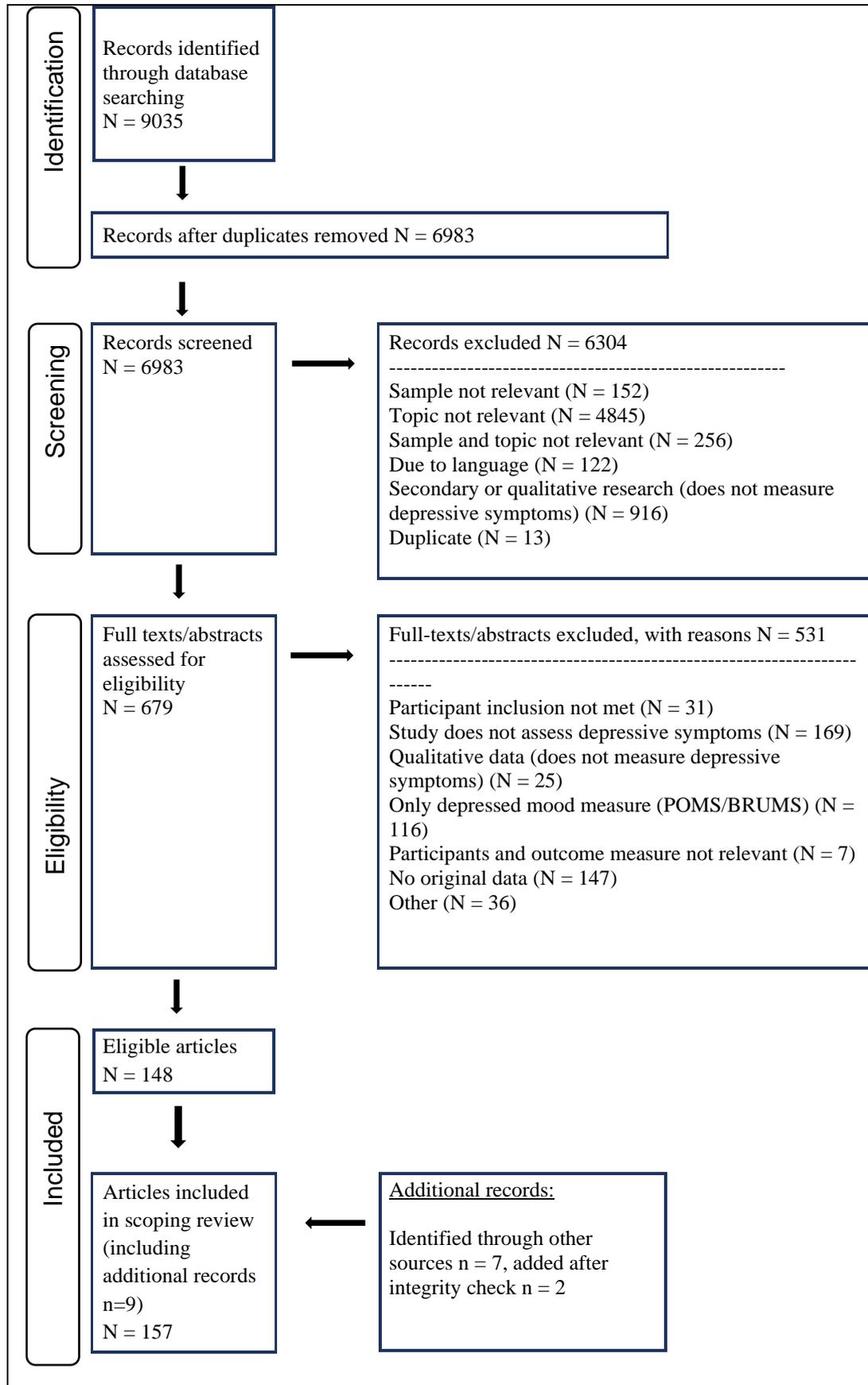
significant disagreements emerged between the authors concerning the coding of study information. However, one dissertation that was initially coded as a single study included two separate studies, and hence this record was included as two separate studies instead of one (Fraser, 2017).

A total of 8062 records were identified through the initial database searches in 2018. With the additional searches conducted in September 2019, the total number of records identified were 9035 (Figure 2). After removing duplicates, 6983 records were screened for title, of which 679 records advanced to full text/abstract screening. Of the 679 texts assessed for eligibility, 148 articles were included. Seven additional articles were identified through hand searches and two additional records were included following the integrity checks (one following RM's check and one following JS's check). Hence, 157 articles were included in the final scoping review. Of the included studies, 147 were in full-text format and 10 in abstract format. The following information was extracted for data synthesis; *article format (i.e. abstract or full text), title, author(s), year of publication, country/countries, aim(s), design, number of depression symptom assessments (in longitudinal/intervention studies), sample size, sample sex, sample age, sample sport and competition level, competitive status (current and/or former athletes), non-athlete control/comparison group, depressive symptoms measure, reliability coefficients and cut-off scores utilised for the measure, and the variables tested (statistically) in relation to depressive symptoms.*

Study 1: Scoping Review of Depressive Symptoms Research

Figure 2

PRISMA flow diagram of the search process



Study 1: Scoping Review of Depressive Symptoms Research

Charting the data

The number of publications by year and country were reported in figures. The research designs and number of depressive symptoms, the depressive symptoms measures, their reported reliability coefficients, age across sample sex/gender, and competition level across competition status (current/former) were collated in tables.

Variables that were statistically tested and reported concerning depressive symptoms were recorded for each study. However, variables that were included in statistical models without being explicitly reported in relation to depressive symptoms (e.g., as control variables), were not included. All identified variables were organised under categories within a multi-level conceptual model adapted from Hankin (2012) as follows: within-individual variables (e.g., genetic, biophysiological, cognitive/behavioural), micro- and meso-level proximal contexts and social and interpersonal influences (e.g. type of sport, social support), and macro-level variables (e.g., culture, ethnicity). Overall frequencies of the occurrence (i.e., tested in relation to depressive symptoms) of each variable across the studies were also reported in figures separately for cross-sectional and longitudinal studies.

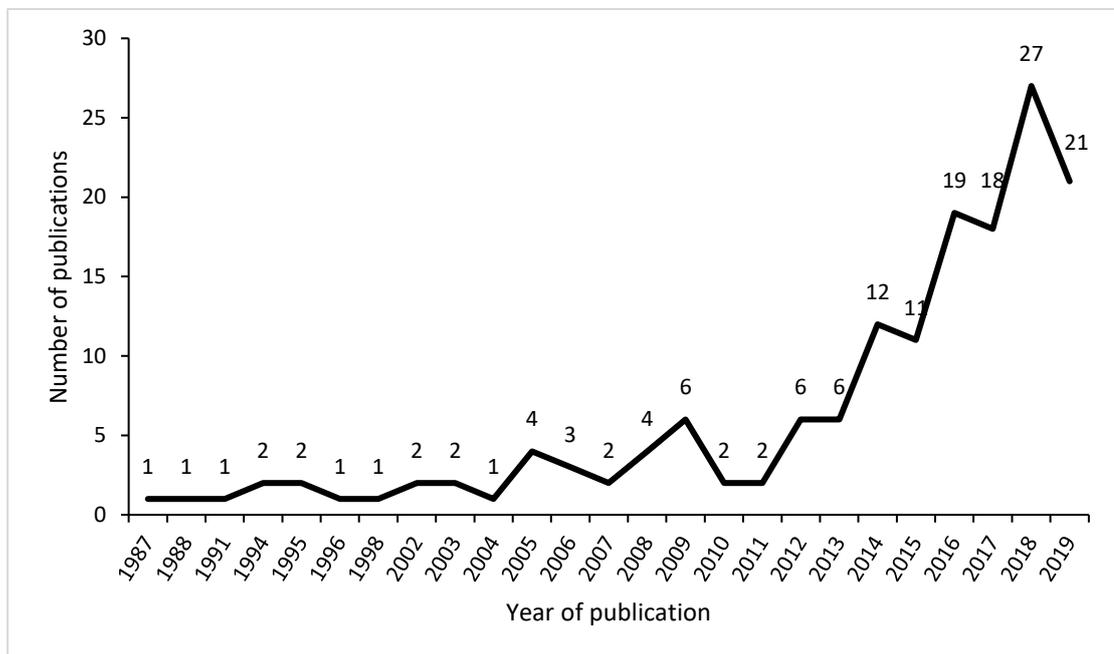
Study 1: Scoping Review of Depressive Symptoms Research

Results

The included studies were published between the years 1987 and 2019 (as of by September 2019; Figure 3). From 1987 to 2013, the frequency of studies ranged from 0 to 6 studies per year. Sixty-nine percent of studies were published after the year 2013, with publication frequency ranging from 11 to 27 studies per year.

Figure 3

Number of research items by year



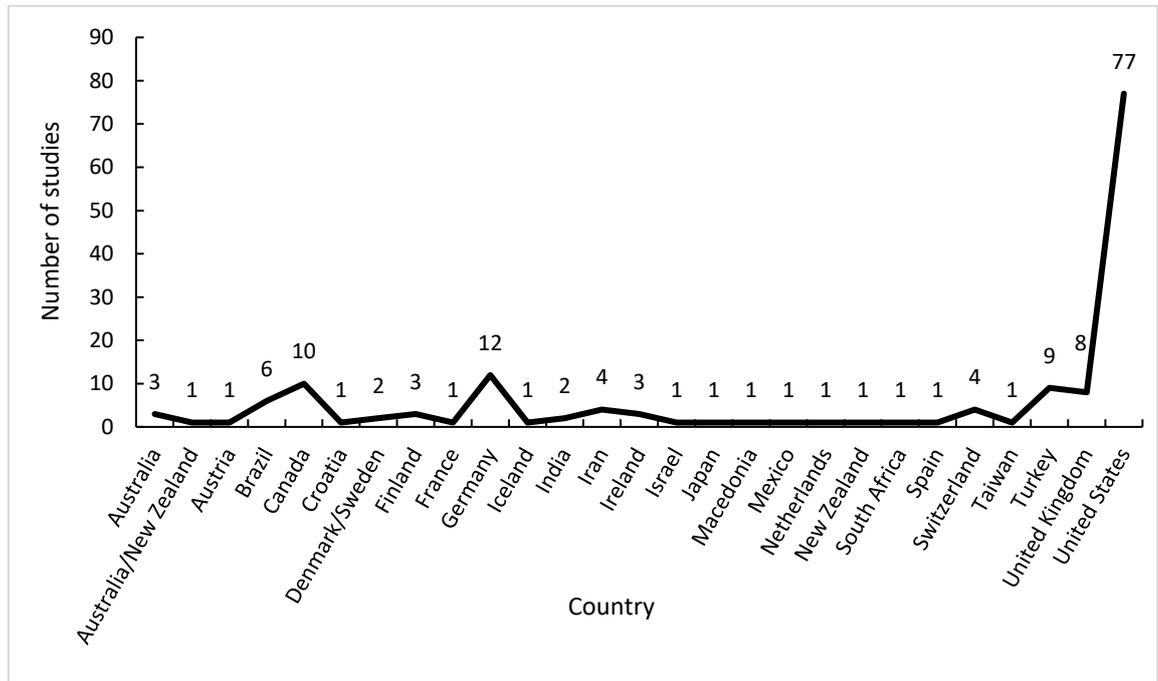
Note. Years 1989, 1990, 1992, 1993, 1997, 1999, 2000, and 2001 omitted from the figure as none of the included studies were published in these years. Data search included studies published by the end of September 2019.

Studies were conducted in 28 different countries, with the majority conducted in the United States ($n=77$, 49.0%; Figure 4). Twelve (7.6%) studies were conducted in Germany and 10 in Canada (6.4%). Three studies (2%) were conducted in multiple countries (e.g., Sweden/Denmark and New Zealand/Australia).

Study 1: Scoping Review of Depressive Symptoms Research

Figure 4

Number of research items by country



Methodology and Instrumentation

Most studies utilised a cross-sectional design (n=116, 73.9%) and 35 studies (22.3%) were longitudinal. Approximately 20% of the longitudinal studies measured depressive symptoms only at one time point (measured only at baseline), either as a predictive variable for other prospective outcome measures, or as an outcome measure of other prospective predictors (measured only at follow-up; Table 2). Six (3.8%) of the included studies utilised an intervention design, of which two studies were identified as randomised controlled trials (Donohue et al., 2018; Glass et al., 2019).

Study 1: Scoping Review of Depressive Symptoms Research

Table 2

Frequency of research designs across all included studies and number of depressive symptoms assessments within longitudinal, intervention, and randomised controlled trials

Design	n	%/N	Number of assessments/time points for depressive symptoms					
			1*		2		≥ 3	
			n	%	n	%	n	%
Cross-sectional	116	73.9	-	-	-	-	-	-
Longitudinal	35	22.3	7	20.6	12	35.3	15	44.1
Intervention	4	2.5	0	0.0	2	50.0	2	50.0
RCT	2	1.3	0	0.0	1	50.0	1	50.0

Note. %/N percentage of total sample N=157, % percentage of studies within the research design. * Longitudinal studies that reported depressive symptoms only once, either at baseline (as a predictive variable) or at follow-up (as an outcome variable).

Table 3 identifies the measures that were used to assess depressive symptoms across the studies, the number of studies that reported prevalence rates of clinically significant depressive symptoms, and the reliability coefficient reported for each measure across studies. Of the 28 different self-report measures identified, the most commonly utilised was the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), with 32 studies (20.4%) utilising the standard CES-D and an additional five studies utilising modified versions (Table 3). Other measures that were commonly utilised were the Beck Depression Inventory (11.9%; BDI; Beck et al., 1961), the Beck Depression Inventory-II (12.5%; BDI-II; Beck et al., 1996), and the nine-item Patient Health Questionnaire (13.1%; PHQ-9; Kroenke and Spitzer, 2002). Two studies utilised depression measures specifically designed for athletes, that is, the Baron Depression Screener for Athletes (BDSA; Polat et al., 2015) and the Stress Response Scale for athletes – depression scale (Hagiwara et al., 2017).

Thirty-six studies (23.0%) assessed internal consistency coefficients at one time point or across several time points, with alpha coefficient ranging from $\alpha=.38$ for the

Study 1: Scoping Review of Depressive Symptoms Research

Brief Symptom Inventory (BSI), to $\alpha=.94$ for the BDI and the BDI-II (Table 3). Six studies reported reliability coefficients over time; Manuel et al. (2002; BDI=.88-.95), McGuire et al. (2017; PHQ-9=.67-.85), Lancaster et al. (2016; Brief Symptom Inventory=.38-.76), Smith et al. (2018; CES-D=.86 - .89), Shanmugam et al. (2014; Symptom Checklist-90-Revised=.89- .91), and Wang et al. (2017; Symptom Checklist-90-Revised=.88-.90).

Half of the studies ($n= 79, 50.3\%$) reported prevalence rates (table 3). For the BDI three studies reported prevalence utilising different cut-off (severity) scores (Barmi, 2011; Leddy & Lambert, 1994; Rodrigues et al., 2017), one study used cut-off >10 (Haslacher et al., 2015), one study >13 (Willer et al., 2018), one study >15 (Manuel et al., 2002), and one study >17 (Levit et al., 2018) when reporting prevalence rates.

For the BDI-II, when reporting prevalence of clinically significant depressive symptoms, four studies reported rates utilising different cut-off scores (Brett et al., 2019; Bunce, 2014; Chen et al., 2008; Covassin et al., 2012), two studies used cut-off >10 (Covassin et al., 2019; Didehbani et al., 2013), two studies used a cut-off score of ≥ 12 (Lodis et al., 2012; Uglesić et al., 2014), three studies a cut-off of >13 (Baker et al., 2018; Hammond et al., 2013; Strain et al., 2017), and one study a cut-off of ≥ 17 (Thomson & Jaque, 2016).

For CES-D, all except one study (Nixdorf et al., 2013, ≥ 23) used a cut-off score ≥ 16 ($n=19$). Eight studies reported prevalence utilising different cut-off scores (i.e., 21, 23 and/or 27). Finally, in ten studies that measured depressive symptoms with the PHQ-9, prevalence rates were reported using a cut-off score of ≥ 10 . A cut-off score > 14 was used in one study (Gerber, Best, et al., 2018a), and one study reported multiple cut-off scores to report prevalence (McGuire, 2014) (for information on cut-off scores for all included studies see appendix 1).

Study 1: Scoping Review of Depressive Symptoms Research

Table 3

Type and frequency of depression questionnaires across studies, frequency of studies reporting prevalence rates and internal consistency coefficients (α)

Measure			Prevalence reported		α reported ^a		α range ^b
	n	%	n	%	n	%	Low - high
BDSA	1	0.6	0	0.0	1	100.0	.65
BDI – all versions (n=46)							
BDI	19	12.1	8	42.1	3	15.8	.85 - .94
BDI-FS	5	3.2	5	100.0	0	0	-
BDI-II	20	12.7	13	65.0	2	10.0	.92 - .94
BDI-SF	2	1.3	1	50.0	0	0.0	-
BSI	7	4.5	2	28.6	3	42.9	.38 - .91
CDI	3	1.9	0	0.0	0	0.0	-
CES-D – all versions (n=37)							
CES-D	32	20.4	20	62.5	7	21.9	.84 - .91
CES-D-10	2	1.3	1	50.0	1	50.0	.78
CES-DC	1	0.6	0	0.0	1	100.0	.84 - .86
CESD-R	2	1.3	1	50.0	1	50.0	.93
DASS-21	11	7.0	4	36.4	3	27.3	.80 - .86
GHQ-28	2	1.3	0	0.0	0	0.0	-
HADS	4	2.5	3	75.0	1	25.0	.68 - .77
MDI	2	1.3	0	0.0	0	0.0	-
MHI-38	1	0.6	0	0.0	0	0.0	-
PAI	3	1.9	1	33.3	1	33.3	.91
PHQ – all versions (n=23)							
PHQ-2	4	2.5	3	75.0	1	25.0	.45
PHQ-9	19	12.1	12	63.2	6	31.6	.67 - .87
PROMIS	3	1.9	1	33.3	0	0.0	-
QIDS-SR	2	1.3	2	100.0	1	50.0	.58
SCL- 90-R	6	3.8	0	0.0	2	33.3	.88-.91
SDHS	1	0.6	1	100.0	0	0.0	-
Zung	1	0.6	0	0.0	0	0.0	-
STPI	1	0.6	0	0.0	1		.84
Stress Response Scale for Athletes - depression scale*	1	0.6	0	0.0	0	0.0	-
The Depression Scale**	1	0.6	0	0.0	1		.91
Wakefield Depression Scale	1	0.6	1	100.0	0	0.0	-

Note. ^aRefers to the total number of studies that reported internal consistency (one or more) for the measure. ^bInternal consistency range across studies within measure. ^a(Alpha range within longitudinal studies included). *Kemuriyama (as cited in, Hagiwara, Iwatsuki, Isogai, Van Raalte, & Brewer, 2017). **Von Zerssen (1976). BDSA= Baron Depression Screener for Athletes, BDI = Beck Depression Inventory, BDI-FS = Beck Depression Inventory-Fast Screen, BDI-SF= Beck Depression Inventory Short Form, BSI= Brief Symptom Inventory, CDI= Children’s Depression Inventory, CES-D= Center for Epidemiologic Studies Depression Scale, CES-D-10= Center for Epidemiologic Studies Depression Scale – short version, CES-DC= Center for Epidemiologic Studies Depression Scale for Children, CESD-R= Center for Epidemiologic Studies Depression Scale Revised, DASS-21= Depression Anxiety and Stress Scale, GHQ-28 = General Health Questionnaire, HADS= Hospital Anxiety Depression Scale, MDI= Major Depression Inventory, MHI-38= Mental Health Inventory, PAI= Personality Assessment Inventory, PHQ = Patient Health Questionnaire, PROMIS= Patient-Reported Outcomes Measurement Information System, QIDS-SR= Quick Inventory of Depressive Symptomatology-Self-Report, SCL-90-R= Symptom Checklist Revised, SDHS= Short Depression-Happiness Scale, Zung = Zung Self-Rating Depression Scale, STPI= State Trait Personality Inventory.

Study 1: Scoping Review of Depressive Symptoms Research

Sample Characteristics

In 58 studies (36.9%), the athlete sample consisted of < 100 participants. In 35 studies (22.3%) sample size was 100 -199, and in 25 studies (15.9%) the sample size was 200-299. Twelve studies (7.6%) reported an athlete sample of 300-399, and four studies (2.5%) 400-499 athletes. Finally, 22 studies (13.8%) consisted of ≥ 500 athletes. One study did not report the sample size of athletes (Dishman et al., 2006).

Mean age range by sample sex is shown in Table 4. The overall mean age or age range was reported in 134 studies (85.4%). The majority of these studies included athletes with a mean age between 16 and 30 years ($n=96$, 61.2%). Twelve studies (7.6%) focused on athletes with a mean age under the age of 16, and 26 studies (16.5%) included athletes with a mean age 31 years or older.

While five studies (3.2%) did not report sample sex for athletes, most studies included male and female athletes ($n=97$, 61.8%). Of the studies that focused on one sex ($n=55$, 35.1%), 81.8% focused on male athletes ($n=45$) and 18.2% ($n=10$) on female athletes.

Table 4

Mean age range by sex distribution of the athlete sample across studies

Sample	Mean age range N (%)				
	<16	16-20	21-30	31-40	>40
Male only	2 (5.3)	9 (23.7)	10 (26.3)	1 (2.6)	16 (42.1)
Female only	2 (22.2)	1 (11.1)	4 (44.4)	2 (22.2)	0 (0.0)
Male and female	6 (7.1)	43 (50.6)	29 (34.1)	3 (3.5)	4 (4.7)

Note. Percentages refer to the number of studies within sample sex

Samples included athletes from multiple (≥ 2) sports ($n = 89$, 56.7%), or one specific sport ($n=39$, 24.8%). Twenty-nine studies (18.5%) did not specify the included sports. Although most multisport samples included a range of different sports, some included a more specific group of sports such as boxing (and controls from other sports,

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n=1), Gaelic games (n=1), swimming and track and field (n=1), marathon and endurance cycling (n=1), ice hockey and American football (and athlete controls, n=2), Wheelchair basketball and rugby (n=1), and rugby (and athlete controls, n=1). In the studies that focused specifically on one sport, the most frequently included sports were American football (n=13) and soccer (n = 10). The remaining single-sport samples included athletes from baseball (n = 2), cross-country running (n=1), ice hockey (n = 3), rhythmic gymnastics (n = 1), rugby (n = 1), running (n = 2), rowing (n = 1), swimming (n = 1), (para) track and field (n = 1), ultra-marathon (n = 1), wheelchair rugby (n = 1), and wrestling (n = 1). Only five studies explicitly reported the inclusion of disabled athletes.

As can be seen in Table 5, most studies focused on current athletes (n=133), in which the samples most frequently consisted of university/collegiate athletes (39.8%), followed by athletes from multiple (≥ 2) competition levels (19.5%), and elite athletes (14.3%). In studies where the sample consisted of former athletes (n=18), professional athletes were most frequently represented (33.3%). In five studies, both current and former athletes were included, and in one study it was unclear whether participants were current or former athletes (Jewett et al., 2014).

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Table 5

Level of competition in studies with current athletes, former athletes, or both current and former athletes

Level of competition (current and/or former, N= 156)	n	%
Current Athletes (n= 133)		
University/Collegiate*	53	39.8
Elementary/high school	9	6.8
Elite	19	14.3
High school and University/Collegiate	4	3.0
Multiple	26	19.5
Olympic *	5	3.9
Professional	1	0.8
Amateur/Not specified	16	12.0
Former Athletes (n= 18)		
University/Collegiate*	3	16.7
Elementary and high school	1	5.6
Elite	3	16.7
High school and University/Collegiate	1	5.6
Multiple	4	22.2
Professional	6	33.3
Current and Former Athletes (n= 5)		
University/Collegiate**	2	40.0
Elite	1	20.0
Multiple	1	20.0
Professional	1	20.0

Note. * Includes Paralympic (n=1) and senior Olympics (n=1). ** Although University/Collegiate was collapsed into one category, samples represented different university student-athlete levels within the North American collegiate system or University athletes outside North America.

Non-athlete comparison groups were included in 45 studies (28.7%), of which 28 studies (62.2%) included student samples, seven studies (15.6%) matched controls, seven (15.6%) studies other specified samples (e.g., patients entering eating disorder treatment), and three studies (6.7%) non-athletes that were not specified. Additionally, six studies (3.8%) compared athletes' depressive symptom scores to existing population norms.

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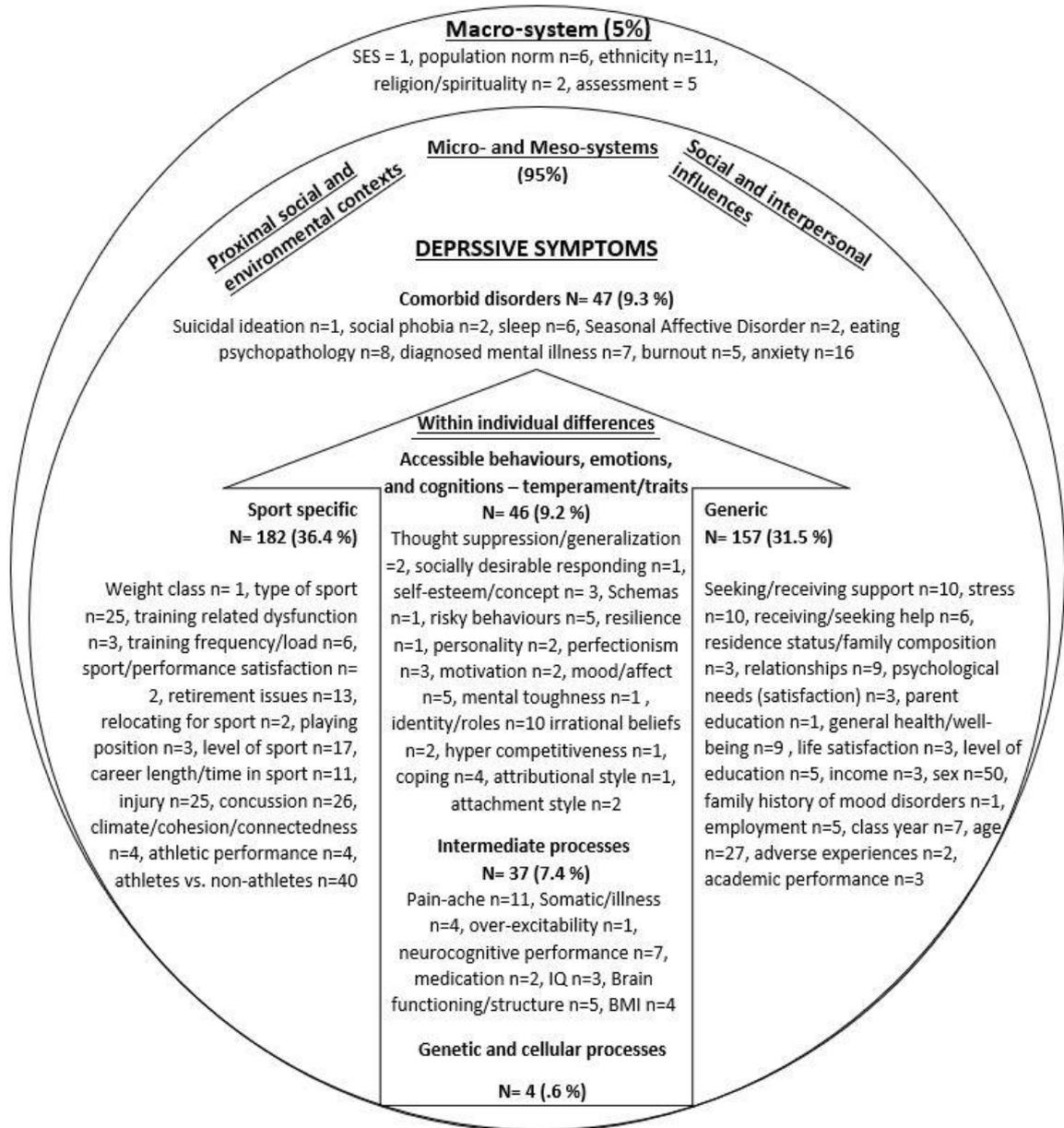
Research emphasis

Seventy-two different variables/topics were identified as being tested in relation to depressive symptoms across the included studies, with variables/topics occurring 497 times across the 157 studies. As can be seen in Figure 5 (for study-specific information see appendix 1), most of the identified variables were categorised as factors relating to social, interpersonal, and contextual variables operating at the micro- and meso-levels. Of these variables, research measured sport-specific (e.g., type of sport; 36.4%) and generic (e.g., age; 31.5%) variables/topics in relation to depressive symptoms. Within-individual factors (e.g. neurocognitive performance, identity, genetics) accounted for 17.2% of observations, while only 5% of all 497 observations were identified as macro-level variables (e.g. population norms, ethnicity).

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Figure 5

Frequency of variables/topics tested concerning depressive symptoms across all included studies



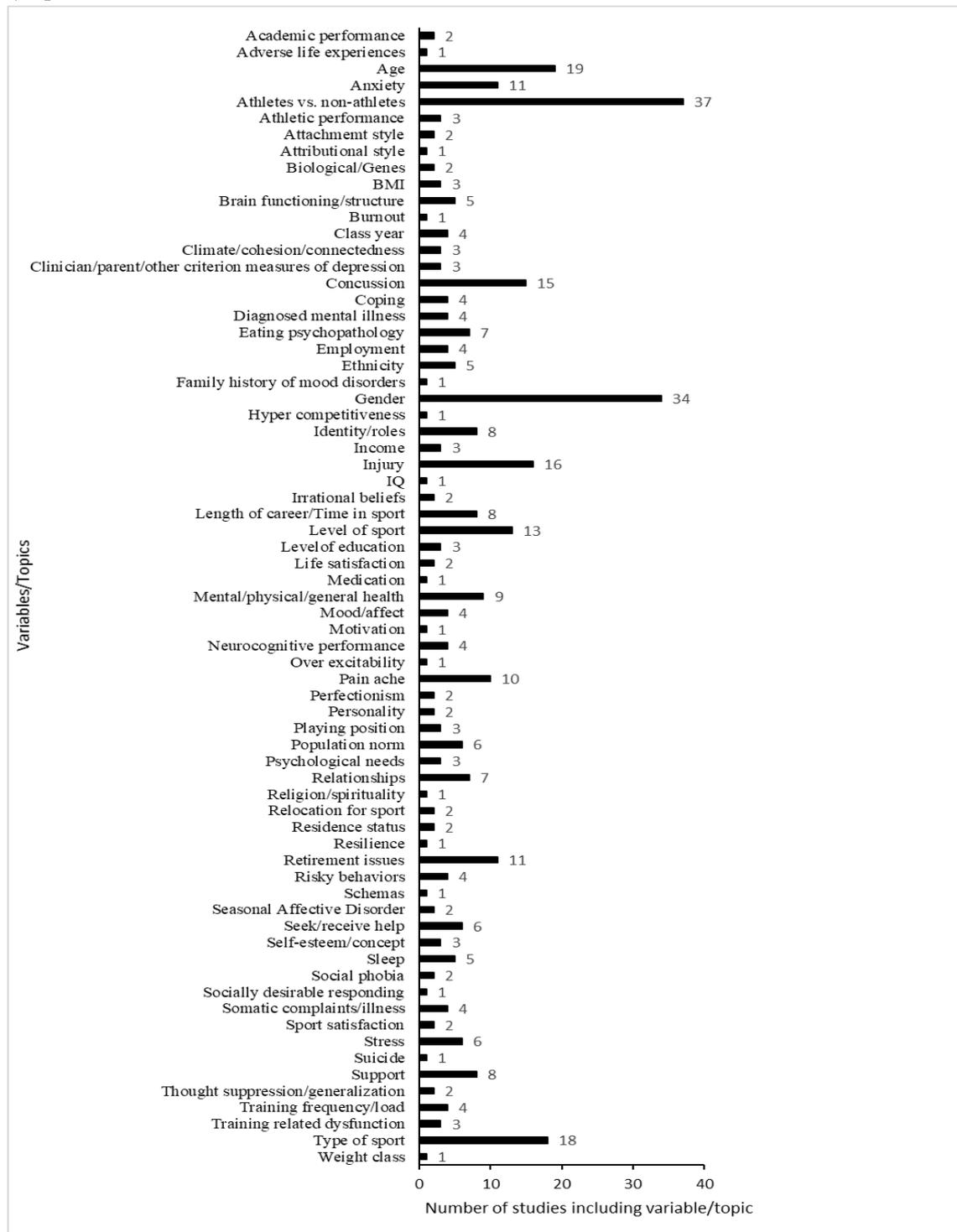
In the 116 cross-sectional studies, the most frequently tested variables/topics in relation to depressive symptoms were; age (n=19), athletes vs. non-athletes (n=37), anxiety (n=11), concussion (n=15), sex/gender (n=34), injury (n=16), level of sport (n=13), pain/ache (n=10), retirement related issues (n=11), and type of sport (n=25;

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Figure 6). Collectively these variables/topics accounted for 51.5% of all 371 observations recorded across the 116 cross-sectional studies.

Figure 6

Number of cross-sectional studies testing variables/topics in relation to depressive symptoms



Note. N=116 studies, N=371 observations)

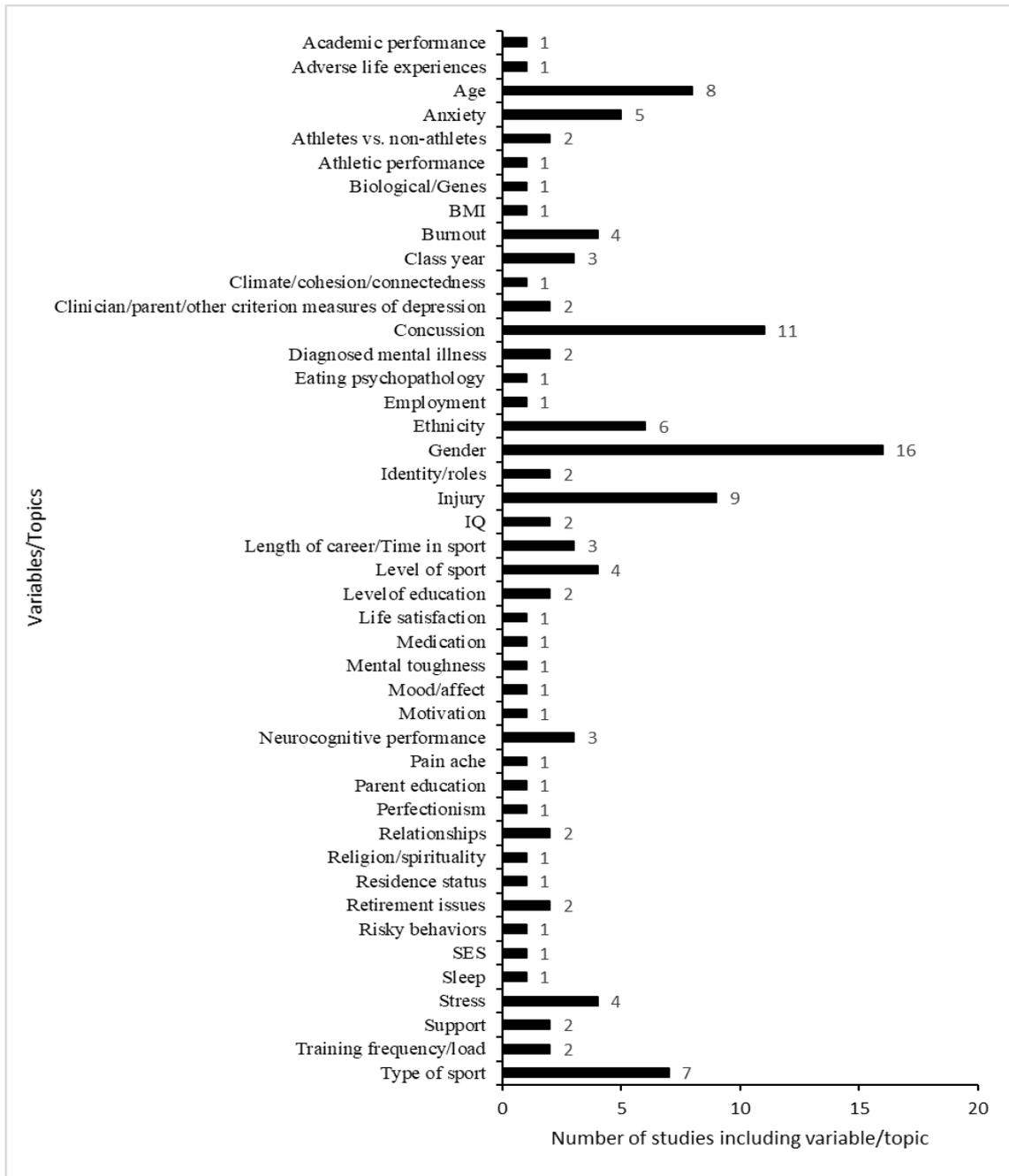
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Out of the 35 longitudinal studies, two studies did not test depressive symptoms in relation to correlating variables, but merely reported change in depressive symptom scores over time. Out of the remaining 33 longitudinal studies, the most frequently measured variables in relation depressive symptoms included, age (n=8), anxiety (n=5), concussion (n=11), ethnicity (n=6), injury (n=9), sex (n=16), and type of sport (n=7; Figure 7). Collectively these variables/topics accounted for 50% of all 124 observations recorded for the 33 longitudinal studies.

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Figure 7

Number of longitudinal studies testing variables/topics concerning depressive symptoms



Note. N=33 studies, N=126 observations

Six studies used an intervention design of which one was conducted with amateur baseball players in Taiwan (Chen et al., 2019), one with elite athletes (sport not specified) and non-athletes in Turkey (Feyzioğlu et al., 2019), and four with collegiate athletes from multiple sports in the United States (Donohue et al., 2015, 2018; Glass et

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al., 2019; Goodman et al., 2014). While all intervention studies measured depressive symptoms over time, only two studies measured other correlates in relation to depressive symptoms. One study measured diagnosed mental disorders (Donohue et al., 2018) and one study compared differences between athletes and non-athletes (Feyzioglu et al., 2019). None of the intervention studies were explicitly focused on the treatment of depression - five interventions were aimed at improving mental health/well-being and/or performance-related outcomes, and one intervention was focused on pain and functionality following an anterior cruciate ligament (ACL) surgery (Feyzioglu et al., 2019). Two studies utilised the same multi-component cognitive-behavioural approach (Donohue et al., 2015, 2018), while three interventions utilised a mindfulness-based approach (Chen et al., 2019; Glass et al., 2019; Goodman et al., 2014). In one study, the intervention consisted of an accelerated physiotherapy (physiological) rehabilitation program (Feyzioglu et al., 2019).

Discussion

In this scoping review, research that has assessed depressive symptoms in athletes was systematically reviewed and the methodological characteristics of these studies were collated. Correlate variables that had been directly tested concerning depressive symptoms in previous research were also mapped. Similar to research on mental health issues in general (Gouttebauge et al., 2019), there has been a notable increase in depression-related research in athletes within the past few years. The findings showed that 69% of studies assessing depressive symptoms in athletes were published after 2013 (as of by the end of September 2019). Another notable finding was that more than half of the studies included in the review were conducted in North America. It is important to note, however, that the search included merely research published in the English language and hence the findings should be interpreted with this

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bias in mind. Nevertheless, the findings underline the importance of further stimulating depression-related research projects and publications in athlete samples across different cultural contexts.

Methodological characteristics

Most studies were cross-sectional (73.9%), while 35 studies (22.3%) utilised a longitudinal design. This finding is in line with results from previous reviews (Golding et al., 2020; Küttel & Larsen, 2019; Rice et al., 2018; Rice et al., 2016), suggesting that we know little about the temporal relationships between potential risk factors and depressive symptoms. Furthermore, although most longitudinal studies assessed depressive symptoms at least two or more time points, approximately 20% of the longitudinal studies measured depressive symptoms only at one time point, either as a predictive variable (measured only at baseline) for other prospective outcome measures or as an outcome measure (measured only at follow-up) of other prospective predictors. As Reardon and Factor (2010) note:

... athletes' depression might have nothing to do with their athletic pursuits or the athletic pursuits could be their way of coping with depression, or it even could be caused by athletic participation. These possibilities have not been studied *per se*. (p. 963).

A decade later, many of these unanswered questions remain. Although it is unlikely that a single causal pathway or mechanism can ever fully explain the development, maintenance, and/or recurrence of depression (Hankin, 2012), longitudinal studies are needed to better understand the temporal relations between risk factors and depressive symptoms in athletes. An improved understanding of these relationships would significantly enhance the ability to target modifiable risk factors and hence, to better prevent and treat depression in the athlete population.

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There was also a general lack of intervention studies that have assessed depressive symptoms. Only one study tested an intervention program designed specifically for athletes in comparison to a non-athlete-specific university campus counselling program (Donohue et al., 2018). The authors reported overall more beneficial mental health and substance use outcomes in the athlete-specific program. While these findings suggest that providing athletes with more tailor-made approaches to treatment could lead to more beneficial outcomes, more research is needed to test the active ingredients by which changes in improvements in athletes are gained. As suggested by Donohue et al. (2018), one reason for the more beneficial outcomes in the athlete specific program may have been due to athletes' increased engagement in the intervention program as it also focused on optimization of athletic performance. Therefore, it may be beneficial for future studies to explore potential underlying mechanisms that may link both to mental health and performance related issues.

Previous findings suggest that there is an on-going debate concerning athletes' risk status in comparison to non-athletes (Armstrong et al., 2015; Gorczynski et al., 2017). As discussed by Gouttebauge et al. (2019) concluding about the athletes' potential risk status in comparison to the general population has been problematic as most studies have not utilised reference groups from the general population. In the current review, it was found that 62% of all included non-athlete comparison groups consisted of student samples. Hence, to date, the understanding of athletes' risk status in comparison to non-athletes is primarily based on comparisons to this specific population. This is an important notion as interpretations of athletes' overall risk-status will have different implications depending on the type of non-athlete comparison groups included in the study.

As shown in this review, a range of different assessment tools have been utilised, imposing different cut-off criteria for reporting prevalence rates. There seems,

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however, to be a positive trend towards utilising well-validated screening tools, such as the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), the Beck Depression Inventory-II (BDI-II; Beck et al., 1996), the Beck Depression Inventory (BDI; Beck et al., 1961), and the Patient Health Questionnaire (PHQ-9; Kroenke and Spitzer, 2002). These measures accounted for 57.3% of the measures utilised across the studies and continued use of these measures in research could provide further consistency in reporting, and hence allowing for better comparisons (e.g. meta-analyses) to be made across studies. Future studies may also want to report prevalence rates across different levels of severity (rather than merely one single cut-off) to provide a more transparent perspective of symptom prevalence in athletes. To improve consistency and transparency across studies, it would also be important that future studies report the internal consistency of the scales. In the studies included in the current review, only 23% of the studies reported internal consistency of the scale. Alphas for the most commonly utilized scale across studies ranged between .67 and .94, while alphas on some other measures reported significantly lower (e.g. PHQ-2 = .45; Ohlert et al., 2019).

Echoing notions made by Gouttebauge et al. (2019), future research would benefit from more research on the psychometric properties of different depression scales in athletes. Other scholars have also highlighted that screening tools for mental health issues should be validated or specifically developed for athletes (Baron et al., 2013; Gouttebauge et al., 2019; Küttel & Larsen, 2019; Polat et al., 2015). The current review identified two athlete-specific measures; the Baron Depression Screener for Athletes (BDSA, internal consistency $\alpha = .65$; Polat et al., 2015) and the Stress Response Scale for Athletes - depression scale (Hagiwara et al., 2017). However, to-date few studies that have explicitly tested the psychometric properties of these measures. It is vital that screening tools (e.g. PHQ-9) are validated in athletes as there may be several issues that

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could complicate the interpretation of results in athletes. For example, it has been underlined that the optimal cut-off score may depend on the setting in which assessment is conducted, that is, the same cut-off score can result in many false-positives in one setting, while leading to more false-negatives in another (Manea et al., 2012). Whether optimal cut-off scores differ significantly between athletes and non-athlete samples remains unanswered, however, considering the specific physiological demands to which athletes are exposed – it is possible that athletes present different symptoms profiles than non-athletes. There is for example significant overlap between symptoms of depression and other conditions highly relevant in the athlete population, such as overtraining syndrome (OTS) (Kreher, 2016). Furthermore, considering that a clinically relevant overall score on a depression questionnaire can be observed in the absence of the two cardinal symptoms of depression (i.e., depressed mood and a lack of interest) (Ingram et al., 2015) – an athlete could exhibit symptoms of fatigue and sleep issues, but no symptoms of depressed mood or lack of interest, and still score above a clinically relevant cut-off score for depressive symptoms. Results on depression screening tools, especially when used in applied settings, may hence need to be interpreted cautiously among athletes (Schuch, 2015). Considering these potential issues with the assessment of depressive symptoms in athletes, future studies could benefit from conducting a detailed analysis of the specific symptomology to explore symptoms that may be especially prevalent in athlete populations. This information may prove useful for gaining a better understanding the symptom profiles of athletes both those who score below and above clinical cut-off scores. Also, this information could promote more evidence-based efforts when designing and implementing future interventions for athletes, as it may unveil important clues about symptoms that are especially relevant in athletes as well as the determinants that may need to be targeted to prevent these issues.

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For example, if type of symptomology is consistently showing unique athlete-specific profiles – treatment and intervention may need to be adapted accordingly.

Sample Characteristics

Most studies included both male and female athletes (61.8%). Of the studies that focused on one gender, more than 80 percent focused on male athletes. This finding is in line with results by Küttel and Larsen (2019) on athlete mental health in general, where 12 studies included male-only samples, and three studies female-only samples. This disparity is interesting (and perhaps troubling), considering that female athletes have shown to report a higher prevalence of depressive symptoms than males (Golding et al., 2020; Wolanin et al., 2015). As noted by Golding et al. (2020), future research is needed to better understand these sex differences in athletes. For example, do observed sex differences emerge due to sport specific determinants or do they merely reflect normative differences that may emerge in early-to-mid adolescence (Hankin & Abramson, 2001; Salk et al., 2016).

Concerning the type of sports that have been prominent in research, more than 20% did not specify the type of sports athletes competed in. Additionally, within studies that did report the type of sports, only 1/3 of these studies focused on specific sports, with the majority focusing on American football and soccer. These findings support the notion made by Junge and Feddermann-Demont (2016) that relatively few studies have explored depressive symptoms within specific sports. Identifying the context which studies have taken place in and reporting findings for particular sports is important as this can further improve the understanding of the potential sport-specific variables that need to be considered in future prevention efforts. For example, although evidence suggests that the context of individual sports may pose a specific risk in athletes (Beable et al., 2017; Nixdorf et al., 2016; Schaal et al., 2011), the sport-environment (and hence

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stressors) are likely to differ depending on the specific type of individual sport.

Consider, for example, contextual differences in figure skating, tennis, fencing, boxing, or rallycross. If the context is not outlined or studies carried out in a broader range of sports, identifying relevant sport-specific variables may not be possible, meaning intervention may not be tailored appropriately.

Most studies focused on current university/collegiate athletes (39.8%), which could explain why most studies also utilised student sample comparison groups. Approximately 20% of the studies on current athletes included athletes from multiple competition levels (e.g. regional, national, or international), and about 14% included elite athletes. It should be noted, though, that some of the athletes identified as University or collegiate athletes could have also been classified as elite athletes (Swann et al., 2015). Considering that the majority of studies have been conducted with multisport samples, evaluating the influence of competition level on depressive symptoms may be challenging. Although some studies do exist (Junge & Feddermann-Demont, 2016; Nylandsted-Jensen et al., 2018), future studies may want to explore further the relationship between competitive level and depressive symptoms within the same sport context. Furthermore, it would be important to identify the potential explanatory factors in the relationship between competitive level and elevated depressive symptoms. This study could subsequently allow for better identification of the central factors that need to be attended to when optimising athlete mental health across different levels.

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Research emphasis

As the reviewed literature shows, several different variables have been explored concerning depressive symptoms in athletes. For this review a multi-level conceptual model by Hankin (2012) was adapted to visually contextualise the type of variables that have been measured in relation to depressive symptoms. Overall, research tested a wide range of proximal sport-specific (e.g., concussion/injury, type of sport) and generic (e.g., age, sex/gender) variables in relation to depressive symptoms. Considering that several of these identified variables can be considered as relatively unmodifiable (e.g. age, injury, type of sport), it may be difficult to target these (and other) risk-factors at the individual level. Hence, as has been recently voiced, more multi-level approaches to prevention and treatment may be required instead (Purcell et al., 2019).

As underlined by Joormann and Arditte (2015), one of the central topics in depression research in the clinical psychology domain has involved the study of vulnerability and resilience. According to the findings, however, a minority of studies have directly tested these variables in relation to depressive symptoms in athletes. For example, cognitive concepts that have been widely researched in clinically oriented psychology research (i.e. perfectionism, attributional style, schemas/beliefs, thought suppression, coping, resilience; Hankin, 2012; Joormann & Arditte, 2015) accounted for only 3% (n=14) of all the observed measurements in this review. Furthermore, although several within-individual variables that have been measured in relation to depressive symptoms were identified, few studies assessed the same variable(s), suggesting that research on within-individual vulnerability is fragmented. To better support athletes, future studies may want to increase focus on within-individual processes or constructs that have been well-researched within the field of clinical psychology (e.g. rumination, negative cognitive styles, perfectionism), and their interaction with both generic and sport-specific social and contextual risk factors.

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Limitations

Although a broad inclusion criterion in terms of the athlete samples, methodology, and research agenda was utilised, studies that were not written in the English language were excluded, and therefore the findings should be interpreted with this cultural bias in mind. Also, mapping such a broad area of variables was not without its challenges as several of the identified variables most likely influence depressive symptoms at through different contexts at multiple levels. For example, male and female athletes could differ in depressive symptoms due to normative developmental effects (biological/interpersonal) or due to sport-specific influences (contextual), or influences may also emanate from the larger societal influences (macro-level). Specific topics where, however, not explored in terms of the empirical findings within the reviewed studies, instead, the aim was to highlight the specific topics that research to-date has prioritised in research. This review provides a novel perspective on current research practices in the study of depressive symptoms in athletes. Findings in this review may hence allow future research to more systematically targeting research efforts in areas where knowledge is still lacking.

Conclusions

The findings highlight the importance of exploring potential explanatory factors in depressive symptoms in athletes through longitudinal research designs. Findings also highlighted that there may be several unique challenges concerning assessment of depressive symptoms in athletes. Hence, future studies could benefit from more fine-grained analyses concerning athletes' depressive symptom profiles, to identify potential symptoms that may be of special relevance in athletes – especially in terms of symptoms profiles among athletes that are identified as exhibiting clinically relevant depressive symptoms. Findings also showed that research on cognitive vulnerability to

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depression in athletes is fragmented and several important vulnerability factors to depression identified in clinical psychology research have not been explored in athletes. Considering, the centrality of cognitive vulnerability on the onset, maintenance, and recurrence of depression – future research in athletes are needed to validate the relationship between cognitive vulnerability and depressive symptoms in athletes through longitudinal research designs. With these considerations in mind, the remaining empirical studies in this thesis will explore the main topics identified in this review; specific depressive symptom, understanding individual vulnerability to depression, and understanding the temporal relationships between vulnerability and depressive symptoms. Considering the importance of assessment related issues in research – the next study (study 2) will first explore assessment of clinically significant depressive symptom scores and the underlying symptom profiles in a sample of Icelandic athletes.

Study 2: Specific Symptoms of Depression

Study 2 - The Bridge

In my scoping review, several gaps in the literature were identified. One major gap in the literature identified was the overall lack of attention to potential issues with using screening tools that have not yet been properly validated in athletes. This may have important implications in the interpretation of results from these measures concerning depressive symptoms in athletes. As all studies included in the review utilized summed symptoms scores to explore depressive symptoms, important information concerning the specific symptoms experienced by athletes remain unexplored. With this backdrop, several important questions that need to be further explored arise - what do clinically significant depressive symptoms mean in terms the type of symptoms athletes may be dealing with? Are athletes experiencing the core symptoms of depression, depressed mood and lack of interest, or are some other symptoms more prevalent? As will become apparent in this next study, exploring these questions is important to better understand the potential implications of findings concerning clinically significant depressive symptoms in athletes. Therefore, the research agenda for this study was set at exploring the nature of depressive symptomology and athletes' susceptibility to the different symptoms that may underlie the summed symptom scores. Another issue identified in study one, was the lack of representative samples from specific sports – limiting interpretations of potential differences across different sports. Hence, in this study, depressive symptoms are explored in Icelandic athletes with large sample sizes across the included sports (i.e., football, basketball, and handball).

What Lies Beneath: Exploring Specific Depressive Symptoms across Selected Risk Factors in Icelandic Team Sport Athletes

As identified in study one, the evidence-base on various depression-related topics in athletes has been growing rapidly in the past decade. However, less attention has been paid to the heterogeneous subset of symptoms that underlie the construct of depression itself (Ringland, 2016; Schuch, 2015), and the potential implications this heterogeneity may have on the interpretation and dissemination of research findings (Golding et al., 2020; Schuch, 2015). Therefore, the definition and assessment of depression will be discussed and how the current study aims to address these issues.

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), major depressive disorder (MDD) is defined as consisting of nine potential symptoms - depressed mood, decreased interest or pleasure (anhedonia), changes in weight or appetite, problems with sleep, psychomotor agitation or retardation, fatigue/loss of energy, worthlessness/guilt, problems with concentration, and thoughts of death. Structured or semi-structured clinical interviews are used to diagnose MDD, and to receive a diagnosis, individuals must exhibit five (or more) depressive symptoms of which at least one must be depressed mood or decreased interest/pleasure (American Psychiatric Association, 2013). Considering that depressed mood or decreased interest/pleasure is the only specified symptom required for a diagnosis, the symptom presentation across individuals diagnosed with MDD can be highly heterogeneous (individuals exhibit different types of symptoms; Zimmerman et al., 2015). There are, in fact, "...roughly 1,000 unique combinations of symptoms that all qualify for a diagnosis of MDD, some of which do not share a single symptom" (Fried & Nesse, 2015, p.2).

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Depression can also be assessed via self-report questionnaires in which the overall symptom severity, rather than a formal diagnosis, is the primary outcome measure (Fried & Nesse, 2015; Ingram et al., 2015). Questionnaires can vary in terms of their assessment period (e.g. symptoms present the past week or past two weeks), and the number and type of symptoms assessed. For example, the Center for Epidemiologic Studies Depression Scale (CES-D, Radloff, 1977) is a 20-item questionnaire and assesses the presence of both positive and negative affect items in the past week. Another commonly utilised self-report measure is the nine-item Patient Health Questionnaire (PHQ-9, Kroenke & Spitzer, 2002), which is specifically designed to assess the presence of the nine depressive symptoms listed in DSM over the past two weeks. Despite the structural differences of depression questionnaires or screening tools, a common feature is that the overall symptom severity is calculated by summing scores from individual symptom items. Specified cut-off points are then imposed to indicate the clinical significance of symptom severity; that is, whether the summed scores reach severity levels that may call for intervention or further assessment (Kroenke & Spitzer, 2002; Radloff, 1977). However, when summed symptom scores are utilised to determine clinical significance, there are no criteria for the type or number of symptoms that must be present (Fried et al., 2016). Consequently, the symptom heterogeneity discussed concerning MDD is further escalated when depression is operationalised in terms of summed symptom scores (Fried et al., 2016). As discussed by Fried (2017), this heterogeneity of underlying symptomology challenges the ability of research to adequately identify and target risk factors, as the underlying symptoms may be highly variable between individuals.

While questionnaires have been the most common method of assessment in depression-related research in athletes (Golding et al., 2020), studies sometimes identify this method as a limitation of their research - highlighting that questionnaires do not

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provide a diagnosis of depression (e.g. Beable et al., 2017; Weber et al., 2018).

However, if questionnaires are not designed to diagnose depression (Levis et al., 2020), then identifying them as a limitation in this context may convey a paradoxical message - implicitly suggesting that, in essence, the objective of the research is to estimate the prevalence of MDD. When this is coupled with the interchangeable use of terms depression and depressive symptoms, there is an increased risk that sum-scores on questionnaires become interpreted as a proxy for MDD (Schuch, 2015). This use of questionnaires would be problematic, however, considering that clinically significant scores could be acquired in the absence of the core symptoms of depression and that clinically significant sum-scores do not require the presence of any specified number of symptoms (Fried & Nesse, 2015). Consequently, on some screening tools such as the PHQ-9, it would be plausible for an athlete to report an elevated score merely on a single symptom and still receive a clinically significant sum-score. In-fact, clinically significant scores could be attained by athletes who would not fulfil a single criterion for a diagnosis of MDD. Indeed, recent findings suggest that screening tools such as the PHQ-9 significantly over-estimate rates of MDD (Levis et al., 2020). Merely identifying athletes with clinically significant depressive symptoms, without considering the underlying symptomology – could consequently lead to incorrect referrals, unbeneficial labelling, and the likelihood of over-diagnosis (He et al., 2020; Joffres et al., 2013; Mojtabai, 2017).

Considering the heterogeneity of depressive symptoms, there is also an inherent disadvantage in interpreting questionnaire data with solely sum-scores, as they may mask important information of the underlying symptomology (Fried et al., 2014; Ingram et al., 2015; Moriarity & Alloy, 2020). Consequently, the interpretation of findings could in some cases turn out to be "...as inadequate as the count of broken bones in a trauma victim" (Fried & Nesse, 2015a, pp., 6-7). This is, however, not to mean that

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sum-scores should not be applied or that they are not meaningful in research or practice, but rather, that there may be several opportunities over and beyond sum-scores that symptom-based assessment could offer. For example, in addition to depressive symptoms increasing the overall risk for developing MDD over time (Ingram et al., 2015), experiencing issues with a specific depressive symptom, such as problems with sleep, can in itself be a significant source of distress and impairment for athletes (Moesch et al., 2018; Reardon et al., 2019; Roberts et al., 2016). Depressive symptoms may also vary in their impact on individuals' psychosocial functioning, and can differ in their salience across different life domains (e.g. work and interpersonal relationships; Fried et al., 2016; Fried & Nesse, 2014). There is also evidence suggesting that depressive symptoms may be differentially related to risk factors. Lux and Kendler (2010), for example, observed that in a sample of individuals diagnosed with MDD, females were more likely to exhibit depressed mood, appetite/weight changes, and fatigue, while males were more likely to exhibit psychomotor agitation/retardation. Furthermore, elevated symptoms of depressed mood and psychomotor agitation/retardation were related to an older age.

Despite the recent developments in research on depressive symptom prevalence and associated risk factors in athletes (Golding et al., 2020; Moesch et al., 2018; Reardon et al., 2019; Wolanin et al., 2015), previous studies have not explored the prevalence of the specific symptoms that may lie beneath summed symptom scores. Exploring specific symptoms in addition to sum-scores offers an opportunity for establishing a richer understanding of the underlying issues that may be especially relevant in athletes. Exploring specific symptomology may also be especially fruitful as this "...may enable the development of personalised prevention that focuses on specific problems and symptoms before they transition into a full-fledged depressive episode" (Fried & Nesse, 2015b, p.4). Against this backdrop, in this investigation, the first aim

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was to *complement* previous research by reporting the overall prevalence rates of depressive symptoms and compare these across age, sex, type of team sport, and level of competition. This study also aims to *extend* current symptom-based research by; 1) exploring the prevalence of the core symptoms of depression (i.e., depressed mood and lack of interest/pleasure) across different sum-score severity, and by identifying the number of additional symptoms exhibited by athletes with or without these core symptoms, and; 2) by testing potential differences in the likelihood of exhibiting specific depressive symptoms across age, sex, type of team sport, and level of competition.

Methods

Participants

The sample included Icelandic athletes competing in football, basketball, and handball. Of the estimated population of Icelandic competitive adult athletes in these sports (N=3641), a total of 1241 athletes (34.1%) participated in the research project. For the current study, however, only athletes who responded to one or more depressive symptom items were included. Therefore, of the 1241 participants, 894 athletes (72.0%) were included in the current study (football=63.2%; basketball=100%; handball=70.5%). More specifically, the current sample for football represented 20.3% of the Icelandic football population (N=2170 across 105 teams) with a total of 441 participants included (age range 18-41 years, male 70.1%). For basketball, the sample represented 36.1% of the Icelandic basketball population (N=659 across 56 teams) with a total of 238 participants (age range 18-41 years, male 62.6%). For, handball, the sample represented 26.5% of the Icelandic handball population (N=812 across 20 teams) with a total of 215 participants (age range 18-42 years, male 51.2%).

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Measures

Depressive symptoms were assessed by the Patient Health Questionnaire 9 (PHQ – 9; Kroenke & Spitzer, 2002), which evaluates the presence of the nine depressive symptoms listed in DSM during the past two weeks: “little interest or pleasure doing things” (interest), “feeling down, depressed, or hopeless” (depressed mood), “trouble falling or staying asleep, or sleeping too much” (sleep), “feeling tired or having little energy” (fatigue), “poor appetite or overeating” (appetite), “feeling bad about yourself - or that you are a failure or have let yourself or your family down” (worthlessness/guilt), “trouble concentrating on things, such as reading the newspaper or watching television” (concentration), “moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual” (psychomotor), and “thoughts that you would be better off dead or of hurting yourself in some way” (suicidal thoughts) (Kroenke & Spitzer, 2002). Each item is scored on a range from 0 to 3, where 0 = “not at all”, 1 = “several days”, 2 = “more than half the days”, and 3 = “nearly every day”, with sum-scores ranging from 0 to 27. The psychometric properties of PHQ-9 have shown to be good among the clinical (Kroenke & Spitzer, 2002) and the general populations (Martin et al., 2006), including the Icelandic population (Palsdottir, 2007). The internal consistency of the scale in the current sample was $\alpha=.86$.

Kroenke and Spitzer (2002) suggested a cut-off score of ≥ 10 (at least moderate severity) for identifying individuals with clinically relevant symptoms. However, it has also been noted that it is essential to report prevalence rates using different cut-off points to offer more valid comparisons across studies (Manea et al., 2012). Considering the exploratory nature of the current study, the prevalence of clinically significant symptoms was reported utilising the cut-offs defined by Kroenke and Spitzer (2002) as at least moderate symptoms ≥ 10 and at least moderately severe symptoms ≥ 15 .

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Furthermore, the PHQ-9 scores can also be analysed using an algorithm method. As described by Manea et al. (2015), when using the algorithm method, clinical significance is determined based on the DSM criteria where at least five symptoms must be present (item scored ≥ 2 , except for suicidal ideation scored ≥ 1)¹, of which at least one must be depressed mood or lack of interest/anhedonia. The algorithm method has low sensitivity (increased risk for false-negatives) but shows excellent specificity (decreased likelihood of false-positives), while the sum-score method has shown to have a more optimal trade-off between sensitivity and specificity (Manea et al., 2015). As the goal of questionnaires (or screening tools) is to overestimate actual rates to minimise potential false-negative cases (failing to identify cases with the condition), the sum-score method has been more commonly utilised (Manea et al., 2015). As the aim of this study was to explore the underlying symptomology in more detail in terms of symptom profiles, prevalence rates were also examined by using the algorithm method.

Procedure

After permission for the study was obtained from the National Bioethics Committee in Iceland (B20171100004 and S1512-00001) and the Icelandic Data Protection Authority, in collaboration with the Icelandic national associations in football (Knattspyrnusamband Íslands, KSÍ), basketball (Körfuknattleikssamband Íslands), and handball (Handknattleikssamband Íslands, HSÍ), the general managers of all clubs in Iceland were contacted and requested to participate and to co-operate in recruiting gatekeepers (coaches) from their respective clubs. Only one football club declined the

¹ When overall prevalence of each symptom is reported (see table 2), to make interpretations of the prevalences across symptoms comparable, a score ≥ 2 was used to identify symptom presence for all symptoms.

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invitation to participate in the study. A link to the questionnaire was sent to the gatekeepers, who then shared the link with their players (age ≥ 18) and encouraged them to participate in the study. Gatekeepers were contacted approximately 2-3 weeks following the initial contact, requesting them to remind the players about the study. All potential participants were informed that participation in the study was optional, responses on the questionnaire were anonymous, and that they could withdraw from the study at any point. Participants were also provided with contact information for psychological support and encouraged to seek help if they were experiencing any type of distress. Participants did not receive any form of compensation for their participation.

Statistical Analyses

Logistic regression models with adjusted odds ratios and 95% confidence intervals were utilised to test differences across two generic (sex and age), and two sport-specific (level of competition and type of team sport) variables on the odds of exhibiting specific depressive symptoms.

Binary dependent variables (specific symptoms) were coded as “0” = not present and “1” = present. For eight symptoms the score of ≥ 2 (“more than half the days” or “nearly every day”) signified the presence of the symptom, however, for the 9th symptom “suicidal thoughts” a score of ≥ 1 (at least “several days”) implied the presence of the symptom (Lux & Kendler, 2010; Manea et al., 2015). Predictors were coded as binary dummy variables with the reference category coded as “0” and each remaining level within the predictor as “1”. Each level (“1”) was then tested separately against the reference category (“0”). The reference group was chosen based on the literature when possible, such as that the reference category was assumed to exhibit the lowest levels of depressive symptoms. The reference categories across predictive variables were male (sex), older (age), and top-level (level of competition). As previous literature has not

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explored differences across the specific sports included in the study, football (type of team sport) was chosen as the reference group (lowest mean sum-score). Due to a low number of female athletes 27 and older – the older female group (reference category) included ages ≥ 24 , while for males, the reference group consisted of athletes ≥ 27 years old.

The logistic regression models for comparing male and female athletes across specific symptoms were adjusted for age, type of sport, and level of competition, while the models comparing different sports were adjusted for sex, age, and level of competition. Analyses on sex differences within athletes with clinically significant scores (PHQ-9 ≥ 10) were, however, un-adjusted due to the low number of athletes in this sub-group (n=72). Models testing differences across age and level of competition were conducted separately for male and female athletes, adjusting for the remaining predictors.

Two participants had one missing value on the PHQ-9 scale (case 1, response on sleep missing, and case 2, response on concentration missing) but were included in the sum-score analyses by replacing the missing value with 0 (symptom not present). Results for sum-score and logistic regression analyses were tested with and without this correction, and there were no notable differences in the outcome. Nine other cases had more than one missing item on the PHQ-9 scale and were therefore not included in the sum-score analyses. However, all cases with valid responses to specific items were included in the logistic regression analyses across specific symptoms. All analyses were conducted using the IBM SPSS version 25.0.

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Results

Sum-score Means and Prevalence across determinants

The overall prevalence of clinically significant depressive symptoms in the sample (N=885) was 8.1 % and 2.7% when applying a cut-off score ≥ 10 and ≥ 15 , respectively. As shown in Table 6, the corresponding prevalence rates when applying cut-offs ≥ 10 and ≥ 15 , were 5.8% and 2.3% for male athletes (N=565), and 12.2% and 3.4% for female athletes (N=320). Kruskal-Wallis test showed that female athletes had a significantly higher prevalence than male athletes when cut-off score 10 was applied [$H(1) = 11.00, p = .001$], however, no significant difference was observed when cut-off 15 was applied. In female athletes, prevalence (cut-off 10) was significantly different between age groups [$H(4) = 11.55, p = .02$], with 18-20-year-olds having significantly higher prevalence rate (19%) than 21-23-year-olds (8.3%, $p = .02$), 24-26 year-olds (6.3%, $p = .20$), and 27-29 year olds (3.8%, $p = .03$). When applying the cut-off score of 15, no significant differences were observed in female athletes across the predictive variables. Independent of the cut-off score used, there were no significant differences in prevalence rates across the predictive variables in male athletes.

As also shown in Table 6, female athletes had significantly higher mean symptom scores (M=5.11, SD= 4.38) than male athletes (M=3.05, SD=3.70) [$t(575.17) = -7.10, p < .001$]. In male athletes, the only mean depressive symptom score difference was found between type of sports [$F(2, 562) = 4.04, p = .018$], with Tukey post hoc test revealing a significantly higher score for male handball players (M=3.93, SD=3.82) than football players (M=2.77, SD=3.35) ($p = .013$). In female athletes, the only significant difference was found across age [$F(4, 315) = 3.90, p = .004$], and according to Tukey post hoc test, this difference was significant between the youngest (18-20 year-old, M= 6.02, SD=4.63) and oldest athletes (30-42 year-old, M= 2.80, SD=3.29) ($p = .004$).

Table 6*Sex-specific sum-score means and prevalence rates across age, competition level, and type of sport*

Factor	Sum-scores (male athletes)							Sum-scores (female athletes)						
	N	M	SD	Severity (cut-off)				N	M	SD	Severity (cut-off)			
				10-27 (≥10)		15-27 (≥15)					10-27 (≥10)		15-27 (≥15)	
				n	%	n	%				n	%	n	%
Total sample score	565	3.05	3.70	33	5.8	13	2.30	320	5.11	4.38	39	12.2	11	3.4
Age														
18-20	143	3.03	3.79	10	7.0	2	1.4	142	6.02	4.63	27	19.0	6	4.2
21-23	146	3.47	4.02	10	6.8	5	3.4	84	4.68	4.14	7	8.3	3	3.6
24-26	117	2.91	3.83	7	6.0	4	3.4	48	4.81	4.56	3	6.3	2	4.2
27-29	76	2.61	3.20	2	2.6	1	1.3	26	3.81	2.82	1	3.8	0	.0
30-42	83	2.94	3.13	4	4.8	1	1.2	20	2.80	3.29	1	5.0	0	.0
Competition level														
Top-level	179	2.97	3.67	8	4.5	3	1.7	142	4.73	4.36	16	11.3	4	2.8
1st division	117	3.51	4.13	10	6.8	4	3.4	178	5.41	4.38	23	12.9	7	3.9
2nd division	86	2.70	3.08	5	5.8	0	.0	-	-	-	-	-	-	-
3rd division	72	2.74	4.00	3	4.2	0	.0	-	-	-	-	-	-	-
4th division	111	3.16	4.04	7	6.3	6	5.4	-	-	-	-	-	-	-
Type of sport														
Handball	109	3.93	3.82	9	8.3	3	2.8	103	5.42	3.65	13	12.6	1	1.0
Basketball	149	2.99	4.18	11	7.4	4	2.7	89	5.52	5.54	14	15.7	7	7.9
Football (soccer)	307	2.77	3.35	13	4.2	6	2.0	128	4.57	3.97	12	9.4	3	2.3

Note. Sum-scores 10-27=Moderate-severe, 15-27=Moderately severe-severe. N=total number of athletes within factor level, n=number of athletes within severity. Scores ≥ 10 considered clinically significant, according to Kroenke & Spitzer (2002). Levels 2nd -4th division includes only male athletes. The third division includes only male basketball and football players, and the 4th division includes only male football players. Bold numbers significant $p < .05$.

Prevalence of Specific and Total Number of Symptoms

Table 7 shows the overall prevalence of the specific depressive symptoms in the sample, and among athletes with and without clinically significant sum-scores.

Prevalence of specific symptoms for the whole sample ranged from 1.6 % for suicidal ideation to 12.2 % for fatigue. Furthermore, the core symptoms of depression, lack of interest and depressed mood were present for most of the days in the past two weeks in 6.8% and 5.9% of the sample, respectively.

Approximately half of the athletes with clinically significant sum-scores exhibited the core symptoms of depression. In terms of the total number of symptoms (Table 7), 75.7% of the sample did not exhibit any symptoms, and 16.3% exhibited 1-2 symptoms. Within athletes who had clinically significant scores, 51.4 % reported 3-4, and 38.9% five or more symptoms.

Table 7

Prevalence of individual depressive symptoms for the sample and athletes with and without clinically significant sum-scores

Factor	Total sample		Symptom sum-score	
	N/n	%	≤ 9 (N=813) %	≥10 (N=72) %
Type of symptom				
lack of interest	894/61	6.8	2.3	55.6
Depressed mood	892/53	5.9	1.6	51.4
Sleep problems	894/71	7.9	3.9	51.4
Fatigue	894/109	12.2	6.9	66.7
Problems with appetite	894/62	6.9	2.0	59.7
Worthlessness/ Guilt	894/76	8.5	3.4	63.9
Concentration problems	894/58	6.5	2.5	50.0
Psychomotor problems	892/26	2.9	1.0	23.6
Suicidal thoughts	888/14	1.6	.0	19.4
Number of Symptoms				
None	885/670	75.7	82.4	.0
1-2	885/144	16.3	16.9	9.7
3-4	885/43	4.9	.7	51.4
≥ 5	885/28	3.2	.0	38.9

Note. N/n=total number of athletes/athletes exhibiting symptom. All symptoms scored 0-3. Symptoms considered present if scored ≥ 2 (“more than half the days” or “nearly every day”).

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Prevalence of Core Symptoms of Depression across Sum-score Severity

Table 8 illustrates the prevalence of the core symptoms (i.e. depressed mood and lack of interest/pleasure) across athletes with different sum-score severity. Of the male athletes with PHQ-9 sum-scores in the 10-14 range (moderate depressive symptoms, $n=20$), 45% did not exhibit either of the core symptoms of depression. Of the male athletes with PHQ-9 scores in the 15-27 range (moderately severe to severe symptoms, $n=13$), 23.1% did not exhibit the core symptoms. In females, 53.6% of athletes within the 10-14 range ($n=28$) did not exhibit the core symptoms, while all female athletes within the 15-27 range ($n=11$) exhibited at least one of the core symptoms. Overall, 37.5% (27/72) of all athletes with clinically significant sum-scores ($\text{PHQ-9} \geq 10$) did not exhibit the core symptoms of depression. However, when the PHQ-9 cut-off ≥ 15 was applied, only 12.5% (3/24) of athletes with clinically significant scores did not exhibit the core symptoms.

Table 8*Prevalence of the core symptoms of depression across sum-score severity*

Factor	Severity sum-score (male)						Severity sum-score (female)					
	0-9 (N=532)		10-14 (N=20)		15-27 (N=13)		0-9 (N=281)		10-14 (N=28)		15-27 (N=11)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Presence of defining symptoms												
Neither	519	97.6	9	45.0	3	23.1	269	95.7	15	53.6	0	.0
Only decreased interest	8	1.5	4	20.0	0	.0	4	1.4	4	14.3	0	.0
Only depressed mood	2	.4	2	10.0	0	.0	4	1.4	2	7.1	1	9.1
Both symptoms	3	.6	5	25.0	10	76.9	4	1.4	7	25.0	10	90.9

Note. Sum scores 0-9=Minimal-mild, 10-14=Moderate, 15-27=Moderately severe-severe. N/n=Total number of athletes within severity category/number of athletes within factor. Scores ≥ 2 (“more than half the days” or “nearly every day”) indicating the presence of the core symptom. Highlighted cases represent athletes with clinically significant symptoms (PHQ-9 ≥ 10), without exhibiting the symptoms of depressed mood and lack of interest.

Number of Additional Symptoms across Athletes with and without Core Symptoms of Depression

The total number of additional symptoms across athletes with or without the core symptoms of depression are presented in Table 9. Of the athletes that did not exhibit the core symptoms of depression (n=813), the vast majority exhibited no other depressive symptoms (82.4%) or 1-2 symptoms (15.1%). Of those athletes that presented only lack of interest (n=20) or only depressed mood (n=11), two athletes (6.5%) exhibited 4 additional symptoms. Of the athletes presenting with both core symptoms of depression (n=39), 61.5% exhibited three or more other symptoms. Hence, overall, 2.9 % (n=26) of athletes exhibited a total of five symptoms, of which at least one was either depressed mood or lack of interest.

Table 9*Number of additional symptoms across athletes without and with the core symptoms of depression*

Factor	Number of additional symptoms (excluding decreased interest and depressed mood)									
	0		1		2		3		≥ 4	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Presence of defining symptoms										
Neither (N=815)	670	82.4	96	11.8	28	3.4	14	1.7	7	.9
Only decreased interest (N=20)	7	35.0	5	25.0	3	15.0	4	20.0	1	5.0
Only depressed mood (N=11)	1	9.1	4	36.4	4	36.4	1	9.1	1	9.1
Both symptoms (N=39)	3	7.7	4	10.3	8	20.5	6	15.4	18	46.2

Note. N/n=Total number of athletes within factor/frequency of athletes exhibiting number of symptoms. Scores ≥ 2 (“more than half the days” or “nearly every day”) indicating the presence of a symptom (for suicidal ideation scores ≥ 1 “several days” or higher implied presence). Highlighted cases identified as clinically significant based on the algorithm method (Manea et al., 2015).

Differences in the Odds of Experiencing Specific Depressive Symptoms across Selected Determinants

Table 10 shows adjusted logistic regression models for each depressive symptom across the selected determinants. Compared to male athletes, female athletes were significantly more likely to report depressed mood, sleep problems, fatigue, problems relating to appetite, feelings of worthlessness/guilt, and problems with concentration (controlling for the effects of age, level of competition, and type of sport). The highest odds for females in comparison to males was found in fatigue (OR=3.88, CI95%=2.37-6.37), depressed mood (OR=2.08, CI95%=1.91-3.97), and appetite-related issues (OR=2.08, CI95%=1.15-3.74). When sex differences were explored among athletes with clinically significant sum-scores (PHQ-9 ≥ 10 ; not included in Table 10), female athletes showed significantly higher odds of fatigue in comparison to males (OR=6.60, CI95%=2.18-19.97), while males showed significantly higher odds of psychomotor issues (OR=.26, CI95%=.08-.84) than females.

Table 10

Binary logistic regression models with odds ratios and 95% confidence intervals of different symptoms across selected determinants

		Interest	Dmood	Sleep	Fatigue	Appetite	Worth/ Guilt	Concentration	Psychomotor	Sthoughts
Sex (reference male)										
Female	OR (<i>n</i>)	1.44 (894)	2.08 (892)	1.92 (894)	3.88 (894)	2.08 (894)	1.78 (894)	1.85 (894)	.63 (892)	1.23 (888)
	CI	.80-2.60	1.91-3.97	1.07-3.46	2.37-6.37	1.15-3.74	1.04-3.04	1.01-3.41	.24-1.63	.69-2.20
Type of sport (ref. football)										
Handball	OR (<i>n</i>)	1.15 (656)	2.43 (654)	3.34 (656)	1.53 (656)	3.69	1.33 (656)	1.76 (656)	1.69 (654)	1.05 (650)
	CI	.57-2.34	1.08-5.46	1.57-7.12	.88-2.67	1.57-8.76	.68-2.62	.83-3.73	.56-5.11	.51-2.13
Basketball	OR (<i>n</i>)	.98 (679)	2.11 (677)	2.19 (679)	1.47 (679)	4.31 (679)	1.67 (679)	1.54 (679)	.81 (678)	.90 (675)
	CI	.48-1.99	.96-4.67	1.07-4.50	.84-2.58	2.03-9.18	.88-3.14	.74-3.20	.25-2.61	.45-1.79
Age (male) (ref. ≥ 27 years)										
24-26 years	OR (<i>n</i>)	1.92 (277)	1.61 (277)	1.90 (277)	2.70 (277)	3.27 (277)	2.17 (277)	1.55 (277)	3.41 (277)	1.54 (276)
	CI	.58-6.31	.39-6.73	.65-5.54	.95-7.67	.57-18.75	.77-6.15	.52-4.62	.81-14.28	.54-4.44
21-23 years	OR (<i>n</i>)	2.16 (306)	3.52 (306)	2.93 (305)	2.37 (306)	4.90 (306)	2.40 (306)	.96 (305)	2.33 (306)	1.98 (305)
	CI	.67-6.95	1.02-12.14	1.11-7.73	.84-6.71	1.01-23.90	.91-6.32	.31-2.95	.56-9.63	.74-5.26
18-20 years	OR (<i>n</i>)	3.03 (303)	2.07 (303)	1.70 (302)	1.99 (303)	7.06 (303)	1.59 (303)	1.26 (302)	1.53 (303)	1.66 (302)
	CI	1.01-9.07	.58-7.43	.58-5.00	.69-5.74	1.52-32.79	.56-4.55	.44-3.62	.32-7.27	.60-4.56
Age (female) (ref. ≥ 24 years)										
21-23 years	OR (<i>n</i>)	2.00 (179)	2.35 (179)	.61 (179)	1.62 (179)	1.83 (179)	2.76 (179)	1.48 (179)	0.00 (178)	1.11 (179)
	CI	.55-7.23	.56-9.85	.43-4.19	.75-3.50	.62-5.42	.91-8.35	.38-5.73	0.00 -	.31-4.01
18-20 years	OR (<i>n</i>)	3.16 (241)	4.78 (239)	2.22 (241)	1.92 (241)	2.37 (241)	3.09 (241)	3.67 (241)	4.14 (240)	2.30 (238)
	CI	1.04-9.67	1.37-16.65	.85-5.78	.97-3.82	.92-6.15	1.12-8.47	1.22-11.09	.49-35.04	.81-6.50
Level (male) (ref. top-level)										
1st division	OR (<i>n</i>)	1.24 (297)	2.29 (297)	2.11 (297)	1.42 (297)	2.79 (297)	2.50 (297)	.77 (297)	4.50 (297)	1.95 (296)
	CI	.47-3.28	.75-6.98	.80-5.57	.58-3.48	.98-8.00	1.02-6.15	.26-2.34	1.16-17.43	.78-4.88
2nd – 4 th division	OR (<i>n</i>)	.95 (450)	.85 (450)	2.50 (450)	.89 (450)	1.52 (450)	1.17 (450)	.90 (450)	1.89 (450)	.81 (448)
	CI	.33-2.72	.24-2.99	.85-7.31	.34-2.37	.40-5.70	.41-3.36	.31-2.61	.35-10.12	.30-2.19
Level (female) (ref. top-level)										
1st division	OR (<i>n</i>)	.76 (326)	.87 (324)	1.83 (326)	1.49 (326)	1.07 (326)	1.07 (326)	1.26 (326)	.50 (324)	1.68 (323)
	CI	.35-1.68	.40-1.91	.84-3.98	.86-2.59	.53-2.22	.53-2.17	.58-2.77	.11-2.37	.72-3.92

Note. Each symptom measured on a scale 0-3 with scores ≥ 2 indicating the presence of the symptom. For suicidal thoughts scores, ≥1 indicated the presence of the symptom. Bold numbers significant p<.05. Dmood =depressed mood, Sthought=suicidal thoughts. Worth/guilt= worthlessness/guilt.

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When football players were compared to players from the two other team sports, handball players had significantly higher odds of experiencing depressed mood, and issues with sleep and appetite, while basketball players showed higher odds of sleep and appetite-related issues than football players (adjusting for sex, age, and level of competition). Most notably, the likelihood of experiencing appetite-related issues more than half the days in the past two weeks was more than four-fold (OR=4.31, CI95%= 2.03-9.18) in basketball players than in football players.

Due to sex-differences in the distribution of scores in age and level of competition, these variables were explored separately for male and female athletes. Models for age were adjusted for the level of competition and type of sport, and models for the level of competition were adjusted for type of sport and age. As shown in Table 10, when male athletes 27 years and older were compared to the other age groups, 18-20- and 21-23- year-olds had significantly higher odds of exhibiting depressed mood and issues with sleep and appetite. Odds of experiencing problems with appetite were notably high, with 18-20-year-olds showing a seven-fold increase in odds (OR=7.06, CI95%=1.52-32.79) and 21-23-year-olds showing an almost five-fold (OR=4.90, CI95%=1.01-23.90) when compared to male athletes 27 years and older. Furthermore, male athletes 18-20-years-old showed significantly higher odds of experiencing a lack of interest than male athletes 27 years and older. Within female athletes, 18-20-year-olds showed significantly higher odds of exhibiting the core symptoms of depression (lack of interest and depressed mood) than female athletes 24 years and older. Female athletes 18-20-years-old also had a higher likelihood of feeling worthlessness/guilt and having problems with concentration. In these comparisons, the most notable difference was found in the probability of experiencing

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depressed mood, with the youngest female athletes having an almost five-fold increase in odds (OR=4.78, CI95%=1.37-16.65) compared to female athletes 24 years and older.

Concerning the level of competition, the only differences were observed between male top-level and male first division players. Male athletes competing in the first division (second-highest level) had significantly higher odds of experiencing worthlessness/guilt and psychomotor issues than top-level players. Most notably, first division players had more than a four-fold increase in odds (OR=4.50, CI95%=1.16-17.43) of experiencing psychomotor issues when compared to top-level players.

Discussion

In this investigation, the aim was to complement previous research by exploring the overall prevalence of depressive symptoms and test potential differences across generic and sport-specific determinants in a large representative sample of Icelandic team sport athletes. Additionally, to further extend knowledge-advancement in the field, the prevalence of specific depressive symptoms was explored, and potential within factor differences (e.g., different age groups) tested in relation to the likelihood of experiencing different types of depressive symptoms.

Sum-score Means and Prevalence across Determinants

The overall prevalence of depressive symptoms in the sample was 8.1 % and 2.7% when applying a cut-off score ≥ 10 and ≥ 15 , respectively. In comparison, Tahtinen and Kristjansdottir (2019) reported a 20.9% prevalence rate in Icelandic individual sport athletes using the PHQ-9 with a cut-off score of 10. Considering that the current study

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utilised the same measure and the same cut-off score, and also explored depressive symptoms in Icelandic athletes – the findings from the current study along with findings by Tahtinen and Kristjansdottir (2019) suggests that Icelandic individual sport athletes may report higher prevalence than the team sport athletes included in the current study. This is in-line with some previous studies that reported significantly higher levels of depressive symptoms in individual sport athletes when compared to team sport athletes (Beable et al., 2017; Nixdorf et al., 2013, 2016).

Female athletes had a significantly higher prevalence of depressive symptoms than male athletes when a cut-off score of 10 was applied, which is in-line with previous findings on sex differences in athletes (Golding et al., 2020). However, no sex differences were observed when applying a cut-off score of 15, suggesting that while female athletes may be more likely than males to experience moderate levels of depressive symptoms, the rates of more severe symptomology may be comparable between the sexes.

Within female athletes, the only significant mean differences emerged between younger and older athletes, and in male athletes, the only difference was found between different sports. This latter finding in the male sample is somewhat surprising considering that football, handball, and basketball are all team ball sports in which the nature of competition (e.g. team-based with competition outcome evaluated objectively, i.e. scoring points/goals) and related stressors such as public evaluation of performance (Doherty et al., 2016) could be expected to be somewhat similar. These findings highlight that while the broader sports categories such as individual and team sports may be linked to different rates of depressive symptoms (Beable et al., 2017; Nixdorf et al., 2016), there may also be important differences across different sports within these broader categories (Rice et al.,

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2016). In line with recent research (Golding et al., 2020; Junge & Feddermann-Demont, 2016; Junge & Prinz, 2018; Nixdorf et al., 2013; Wolanin et al., 2016), this study emphasises the need for more fine-grained analyses across different sports to understand better factors that may contribute to elevated depressive symptoms in athletes.

Prevalence of Specific Symptomology

In the current sample, the prevalence of specific depressive symptoms (symptom present at least most of the days in the past two weeks) ranged from 1.6 % for suicidal ideation to 12.2 % for fatigue. As shown in the current study and previous research, fatigue (low energy/tiredness) is a common symptom in athletes (Birrer et al., 2013; Matos et al., 2011) and could therefore represent an important target for future prevention programs independent on the type of athletes the program is designed to support.

As most studies to date have utilised questionnaires to assess depression in athletes – current knowledge of athletes' susceptibility to major depressive disorder (MDD) is mostly unknown (for a notable exception see Schaal et al., 2011). Nonetheless, research in athletes has tended to utilise the terms depression and depressive symptoms interchangeably when discussing clinically significant depressive symptom sum-scores, potentially clouding the meaning and interpretation of findings across studies (Schuch, 2015). One of the aims of this study was, therefore, to explore sum-scores from the perspective of DSM criteria. Several studies in athletes have utilised PHQ-9 scores ≥ 10 as a cut-off for identifying clinically relevant cases and reporting prevalence rates (Bell et al., 2016; Du Preez et al., 2017; McGuire et al., 2017; Silva-Rocha et al., 2019; Tahtinen & Kristjansdottir, 2019). However, when applying this cut-off, athletes could attain clinically

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significant scores without exhibiting the core symptoms of depression (i.e. lack of interest and depressed mood). Indeed, it was found that 37.5% of all athletes who had clinically significant sum-scores (PHQ-9 ≥ 10) did not exhibit the core symptoms of depression. However, this was reduced to 12.5% among athletes with moderately severe to-severe sum-scores (PHQ-9 ≥ 15). Furthermore, 45% of male and 53.6% of female athletes with moderate depressive symptoms (PHQ-9 scores 10-14) did not exhibit the core symptoms of depression. According to Kroenke et al. (2001), the PHQ-9 shows increasing specificity (decrease in potential false-positive cases), but attenuated sensitivity (increase in potential false-negative cases) as cut-off scores are increased within the moderate depressive symptom range (scores 10-14) and hence, this range has also been identified as the “grey zone”. Considering that approximately half of the athletes scoring within the “grey zone” did not exhibit the core symptoms of depression - it could have been deemed misleading to define athletes with clinically significant symptoms scores in the 10-14 range as “depressed” athletes. On the other hand, using a higher cut-off point could potentially lead to increased risk of missing “true” cases. Although the sensitivity and specificity of the PHQ-9 scale was not tested in relation to diagnostic interviews, these findings provide new insights into the underlying symptomology in athletes with clinically significant sum-scores.

As discussed in the introduction of this study, it would also be plausible for an athlete to report an elevated score merely on a single symptom, and still receive a clinically significant sum-score. However, 90% of athletes who had clinically significant depressive symptoms exhibited at least three symptoms. To further understand clinically significant symptoms in the current sample, an algorithm method was applied to explore the number of

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athletes that self-reportedly fulfilled the DSM criteria for exhibiting a minimum of five symptoms, of which at least one symptom was either depressed mood or lack of interest. Overall, 2.9% of athletes self-reported meeting these criteria, which is considerably lower than the 8.1% prevalence observed when cut-off score 10 was applied, and closer to the prevalence rate obtained by a cut-off 15 (2.7%). This rate is also similar to the 3.6% prevalence reported in a study among French elite athletes who were assessed using semi-structured diagnostic interviews (Schaal et al., 2011). Only one known study to date has reported prevalence rates in athletes using both self-report questionnaires and clinical interviews. In their research, Hammond et al. (2013) found that 34% of elite swimmers met DSM criteria for a major depressive episode when assessed by clinical consultations, while 22% reported mild and only 4 % moderate levels of depressive symptoms when assessed by the Beck's Depression Inventory-II (BDI-II). Considering that screening tools are designed to over-estimate actual cases (Manea et al., 2015), finding a higher number of cases by clinical interviews than questionnaires is surprising. The optimal cut-off score may depend on the setting in which assessment is conducted, that is, using the same cut-off score can result in many false-positives in one environment while leading to more false-negatives in another (Manea et al., 2012). Hence, considering the findings in the current study and those reported by Hammond and colleagues (2013), future studies are needed to validate existing screening tools in different athlete populations.

Differences in the Odds of Experiencing Specific Depressive Symptoms across Selected Determinants

When compared to male athletes, female athletes showed significantly higher odds of exhibiting depressed mood, sleep problems, fatigue, problems relating to appetite,

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feelings of worthlessness/guilt, and problems with concentration. Furthermore, among athletes with clinically significant sum-scores, females were more likely than males to experience fatigue, while males were more likely to experience psychomotor issues. These findings are in-line with those reported by Lux and Kendler (2010), where females diagnosed with MDD were more likely than males to exhibit depressed mood, appetite/weight changes and fatigue, while males were more likely to experience psychomotor issues. The symptom-specific analyses in the current study, therefore, extend current knowledge and suggests that the higher overall depressive symptom sum-scores identified in females is reflected in several of the underlying symptoms.

It is interesting to note that while the key symptoms differing within the male sample were related to neurovegetative symptoms (sleep and appetite), within female athletes, variability was more prominent in cognitive symptoms. For example, when compared to older female athletes, the youngest female athletes had significantly higher odds of exhibiting a lack of interest, depressed mood, worthlessness/guilt, as well as concentration problems. Most notably, younger female athletes (18-20 years) had almost a five-fold increase in odds of experiencing depressed mood compared to female athletes 24 years and older. Relatively few studies in athletes have, however, explored depression, or other mental health issues, specifically in female athletes (Golding et al., 2020; Küttel & Larsen, 2019). Considering that female athletes exhibited higher prevalence rates across several specific symptoms when compared to male athletes, attention in future research, prevention, and applied efforts should be directed at this population.

While the sum-score analyses identified overall differences between football players and handball players, symptom-specific analyses revealed additional findings. Both

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handball and basketball players were more likely to report issues with sleep and appetite in comparison to football players. Also, handball players were more likely than football players to report experiencing depressed mood. Depressed mood and issues with sleep and appetite were also the key symptoms in males when age differences were compared between older and younger athletes. The odds of experiencing issues with appetite were notably high in males, with 18-20-year-olds showing a seven-fold and 21-23-year-old showing an almost five-fold increase in odds, compared to male athletes 27 years or older. Regulation of sleep and appetite has shown to be related to similar biomarkers among depressed patients (Caroleo et al., 2019). Based on the findings in the current study, these specific symptoms could provide an interesting avenue for further research in depression-related research in athletes.

Level of competition did not contribute to differences across depressive symptoms within female athletes. Considering that the adjusted analyses demonstrated more variability across age than the level of competition, the higher susceptibility to elevated depressive symptoms of lower-level athletes found in previous studies (Junge & Feddermann-Demont, 2016; Junge & Prinz, 2018; Nixdorf et al., 2013) may be better explained by age-related differences. Nevertheless, while controlling for the effects of age and type of sport, it was found that male athletes competing in first division (second-highest level) had significantly higher odds of experiencing worthlessness/guilt and psychomotor issues than top-level players. While the findings concerning differences in psychomotor issues may be challenging to interpret, the observed difference in worthlessness/guilt could perhaps be understood through the lens of athletic identity (Brewer & Petitpas, 2017). As there may be similar physical and psychosocial demands

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(e.g. training and competition load) for the first division and top-league players in Iceland, a strong identification with the athlete role may be comparable between these groups. However, the threats to athletic identity may be more pronounced for the first division players as the sport career prospects may be less secure than for the top-level players.

Overall, the findings in the current study highlight the importance of more fine-grained exploration of the underlying symptomology in parallel to reporting sum-scores when assessing depressive symptoms in athletes. If results are interpreted only in terms of summed scores, important information may be lost, and interpretations may have limited utility in terms of knowledge advancement in the field. Using only summed scores in applied settings may also mask important information when making decision concerning referrals or potential intervention initiatives. Future research could take these analyses further and explore how different symptoms may relate to athlete functioning, in and out of sport, and explore the relationships within prospective research designs.

As noted by Purcell et al. (2019), it is also important to understand athlete mental health from a broader ecological perspective. It is proposed that exploring individual symptoms, rather than only sum-scores, could significantly contribute to this understanding in future research. For example, by providing more detailed information about the specific symptoms that may be especially prevalent in different athlete populations, future research could more systematically map the relevant contextual risk factors that may contribute to these symptoms. Applying a more detailed exploration of the underlying symptomology could also generate useful information for more theory-driven approaches to understanding depression and depressive symptoms in athletes – and therefore, the development of more targeted and tailor-made approaches to intervention in the future (Nixdorf et al., 2020).

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Limitations

Some limitations to the current study should be noted. Firstly, the mean difference analyses did not consider potential differences emanating from unmeasured third variables and therefore, these unadjusted mean differences should be interpreted with this limitation in mind. This study was also cross-sectional and can only be considered descriptive of prevalence at one point in time. There is now evidence suggesting that prevalence rates may vary over a competitive season (Du Preez et al., 2017; McGuire et al., 2017) and hence, the reported rates should not be considered static. Furthermore, although the sample sizes across the included sports were large – almost 40% of football players and 30 % of handball players did not respond to the depression symptom items and were therefore excluded from the current study. Consequently, the representativeness of the findings should be interpreted with this limitation in mind. In terms of the logistic regression analyses, the overall rates for some symptoms (e.g. psychomotor) were low, which may have biased the odds ratio estimates. Furthermore, it should be noted that several of the PHQ-9 items do not make a distinction between the direction of symptom presentation (e.g. eating too little or overeating, sleeping too much or too little). Hence, the exact nature of the issues relating to these symptoms were not specifically explored.

Despite the limitations, this study offers an important addition to previous depression-related research in athletes. Analyses were conducted in a large representative sample of team sport athletes from three popular team sports in Iceland. This sample also provided sufficiently large sub-samples across the different sports allowing for more detailed (adjusted) analyses to be made across these athlete groups. The methodological

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approach taken to explore the prevalence of specific depressive symptoms was also novel in the athlete literature.

Conclusions

This study explored a novel topic within the athlete literature, aiming to increase current understanding of specific depressive symptoms in a large representative sample of Icelandic athletes. While research in athletes often note that depression questionnaires are limited in their ability to provide a depression diagnosis, few have explored the opportunities that questionnaires can offer, over and beyond the more commonly utilized sum-scores. As this study showed, there is a wealth of information to be gleaned by analysing the specific symptoms of depression. The initial findings suggest that female athletes report more symptoms than male athletes. Younger female athletes (18-20 years) in comparison to older (≥ 24) may be especially prone to exhibit cognitive symptoms of depression, while younger male athletes (18-20) in comparison to older males (≥ 27) may be especially prone to experiencing issues with sleep and appetite. The study also showed that when utilizing the PHQ-9 cut-off 10 to identify clinically significant depressive symptoms, almost 40% of the identified cases did not exhibit depressed mood or lack of interest. Hence, it is important to acknowledge that athletes who score above a clinical cut-off criterion on screening tools, may not necessarily suffer from mood related issues, but experience issues relating to sleep, appetite or fatigue. It is, however, important to underline that 90% of athletes with clinically significant symptoms reported having experienced at least 3 different depressive symptoms most of the days in the past two weeks. Hence,

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although some athletes in this group did not experience the core symptoms of depression, they may have nevertheless experienced significant distress.

While the findings from this study significantly adds to current knowledge about depressive symptoms in athletes, studies should explore specific symptoms in other athlete samples to further build on the knowledge acquired in this study. Furthermore, as identified in this study - current knowledge concerning potential explanatory factors to the observed differences across athletes in depressive symptoms is lacking. As research in non-athletes has shown, differences in cognitive vulnerability to depression provides strong theoretical and empirical support for the mechanism by which individual differences in depressive symptoms emerge. Therefore, to move beyond descriptive accounts concerning prevalence rates and demographic risk factors, theoretically informed approaches to exploring underlying vulnerability to depression is needed in athletes. This gap will be addressed in the next study of this thesis (study 3).

Study 3 - The Bridge

As identified in study one, several studies (including study two in this thesis) have primarily focused on unmodifiable risk factors (e.g. age, level of competition) when exploring factors that may be linked with increased susceptibility to depressive symptoms in athletes. While it is important to gather information about potential in-risk athletes and the types of stressors may be related to depressive symptoms, these studies do not explain why individual differences emerge – and therefore lack explanatory specificity about targets for prevention and treatment in athletes. Hence, theory-driven research is needed to move the field towards a richer understanding of the potential mechanisms that contribute to depressive symptoms in athletes. According to cognitive vulnerability theories, underlying cognitive qualities and processes contribute to individual differences in the onset and maintenance of depression. These theories assume that the underlying cognitive mechanisms are causal factors and are hence often targets in treatment. Consequently, validating the assumed relationship between cognitive vulnerability and depressive symptoms in athletes can offer important road signs for developing empirically and theoretically sound approaches to treatment and prevention in athletes. The response styles theory identifies depressive rumination as a core vulnerability factor to depression. As outlined in the background chapter of this thesis, there are several reasons why exploring this particular vulnerability factor may be fruitful in athletes. As rumination is a process-oriented vulnerability factor (i.e. attentional processes) it may also be a relevant factor in terms of performance outcomes. Furthermore, as identified in study one, initial findings on athlete-specific mental health interventions that aim to target mental health as well as performance related issues, showed higher athlete engagement to the intervention when

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compared to traditional on-campus counselling. Therefore, in this third study, the aim was to address an important gap in previous literature, while doing so with the potential sport-specific relevance of the theoretical approach in mind.

**Me, Myself, and My Thoughts: The Influence of Brooding and Reflective Rumination
on Depressive symptoms in Athletes**

Frank et al. (2015) underlined the importance of validating knowledge acquired from general and clinical populations in athletes. As identified in study one of this thesis research on cognitive vulnerability has been fragmented, and research on potential cognitive mechanisms relating to depressive symptoms in athletes are lacking. This study aims to extend mental health research in athletes by seeking to clarify the relationship between depressive rumination and depressive symptoms, therefore addressing an important gap identified in study one. Several empirical studies have provided evidence on the potential importance of depressive rumination, indicating that it has a central role in the onset (Just & Alloy, 1997; Nolen-Hoeksema, 2000), maintenance (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 1997; Spasojević & Alloy, 2001), and recurrence of depression and depression symptomology (Michalak et al., 2011). Although rumination has been previously highlighted as an important vulnerability factor in the athlete mental health literature (Uphill & Dray, 2009), and often appears in texts when research findings are discussed - rumination itself has rarely been tested empirically in athletes (Kröhler & Berti, 2019).

In the Response Styles Theory (Nolen-Hoeksema, 1991) and its subsequent revisions (Nolen-Hoeksema et al., 2008; Watkins & Nolen-Hoeksema, 2014), depressive rumination is defined as a relatively stable cognitive vulnerability factor, which entails habitual cognitive processes that emerge in response to sad or depressed mood. As proposed by Nolen-Hoeksema (1991), in individuals with a high tendency to ruminate, negative mood has a robust attentional valence which triggers thought processes about the

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negative mood, and the implications it may have for the individual. Treynor and colleagues identified two separate factors of depressive rumination: brooding and reflective pondering (reflection). In testing the relationship between these factors, Treynor et al. (2003) found that brooding was related to higher levels of depression concurrently and longitudinally. Although reflection was also related to more depression concurrently, it was associated with less depression over time. Lo et al. (2008) supported this finding, demonstrating that brooding, but not reflection, mediated the effects of negative attributional/cognitive style on depression. Consequently, reflective rumination has been characterised as goal-directed, cognitive response style in response to negative mood, while brooding is characterised as a more passive (vs. active approach behaviours to dealing with issues at hand), abstract (vs. concrete problem solving), and evaluative (vs. accepting) processing style that focuses specifically on the symptoms, causes and implications of ones' negative mood (Treynor et al., 2003). Nevertheless, the role of reflection as a more adaptive trait is still uncertain and is likely to be dependent on individuals' tendency to brood as well as on their current levels of depression (Joormann et al., 2006).

An impaired ability to disengage from negative stimuli (e.g. negative mood) is the key component by which depressive rumination increase vulnerability to depression (Koster et al., 2011). This may be especially relevant in terms of brooding rumination which may be driven by automatic, rather than goal-directed, attentional processes (Koster et al., 2011). In a similar vein, attentional processes are the key to understanding psychological states that underlie optimal athletic performance. Recently, a model of optimal performance was introduced by Swann et al. (2017). The key element of optimal performance state according to this model lies heavily on the athletes' ability to flexibly direct attention on the performance task in accordance with the situational demands.

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Considering the centrality of attentional processes in optimal performance states as well as in the onset and maintenance of depression – exploring depressive rumination as a vulnerability factor to depressive symptoms in athletes is highly relevant. Furthermore, as reported by Donohue et al. (2018) an athlete specific treatment program that addressed both performance and mental health-related issues in university athletes, showed better athlete engagement in the intervention, compared to athletes assigned to a traditional non-sport-specific counselling program. The findings also showed more beneficial mental health and substance use outcomes in the athlete specific program. Considering that depressive rumination may link to negative performance (Bennett et al., 2016) outcomes in athletes, exploring this vulnerability factor seems highly relevant.

In sum-the current study aims to fill an important gap in current literature, in which there has been a general-lack of theoretically informed research to understanding individual differences in depressive symptoms in athletes. The findings from this study can be expected to be impactful for applied work in athletes, providing initial evidence of the potential utility of approaching treatment and prevention through the lens of the response styles theory. It will also pave the way for future research within the field – potentially providing new ideas and avenues for further knowledge advancement. The aims of this study were to: (1) report prevalence and severity rates of clinically relevant depressive symptoms, and in-line with study two, to explore prevalence of specific symptoms of depression; (2) explore potential differences in depressive symptom and depressive rumination scores (brooding and reflection) across athlete characteristics; and (3) test whether athletes with different types of brooding and reflection (vulnerability) profiles would differ in rates of clinically relevant depressive symptoms. Based on previous studies presented in the background section of this thesis, it was hypothesised that female gender,

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lower level of competition, engaging in individual sports, and being currently injured would relate to higher depressive symptom scores (aim 2). In terms of brooding and reflection, no specific hypotheses were set regarding differences across sport-related variables. However, it was expected that brooding and reflective rumination scores would be higher in female athletes than in male athletes (aim 2). Finally, it was hypothesised that athletes with a high tendency to engage in brooding and high reflective rumination in response to negative mood, would be more likely to experiencing clinically relevant depressive symptoms when compared to athletes with a low tendency to brood and reflect (aim 3). Considering that the role of reflective rumination as an adaptive trait is still unclear, no specific hypothesis was set concerning the relationship between a high reflection/low brooding profile and the odds of experiencing depressive symptoms.

Methods

Participants

The participants in the present study were 286 competitive athletes (62.0% male, age range 18-69 years) in the UK. Competitive athletes were defined as athletes who were currently taking part in formal competitions at any level, and who reported the main sport in which they were currently competing. The majority of athletes were UK citizens (87.4%), and 89.9% reported being of white/Caucasian ethnic background. Other ethnic backgrounds included mixed/multiple (3.5%), Black/African/Caribbean/Black British (3.1%), Asian/Asian British (2.4%), and Arab (.3%). Two participants did not report ethnic background. More than half of the athletes (53.5 %) had been selected to represent their country at some point during their athletic careers, and 30.5 % were currently competing at international/top tier professional level. The most frequently reported male sports (or

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clusters of sports) were rugby (n=25), ultra-marathon/marathon/running (cluster; n=21), ironman/triathlon/duathlon (cluster; n=16), martial arts (cluster; n=13), golf (n=14), football (soccer; n=13), ice hockey (n=11) and swimming (n=9). The most frequently reported female sports were rowing (n=12), ironman/triathlon/duathlon (cluster; n=11), volleyball (n=6), water polo (n=6), and martial arts (cluster; n=5). In total, athletes represented 54 different types of sports.

Measures

The *Patient Health Questionnaire 9 (PHQ – 9)* assesses depressive symptoms (present more than half the days) during the past two-weeks (Kroenke & Spitzer, 2002). Each item is scored from ‘0’ to ‘3’ ranging from “not at all” to “nearly every day”, thus total scores range from 0 to 27. For exploring specific symptoms of depression, for each specific symptoms the score of ≥ 2 (“more than half the days” or “nearly every day”) signified the presence of the symptom. The psychometric properties of PHQ-9 have shown to be good among the clinical (Kroenke & Spitzer, 2002) and the general population (Martin et al., 2006). The internal consistency of the scale in the current sample was $\alpha=.88$.

The *Ruminative Responses Scale - short form (RRS-short form)* is a 10-item scale adapted from the original 22-item RRS to measure rumination in response to depressed or negative mood, without including items confounded by depression content (Treyner et al., 2003). The 10-items in the RRS-short form consist of five reflective pondering (reflection) items, such as “Analyse recent events to try to understand why you are depressed”, and five brooding items, such as “Think why do I have problems other people do not have?”. Respondents rate each of the 10 items in the questionnaire from 1 (almost never) to 4

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(almost always), with higher scores representing higher tendency to engage in reflective and brooding rumination when feeling low, sad or depressed. The internal consistency of the scales in the current sample were $\alpha = .82$ for brooding and $\alpha = .79$ for reflection.

Ethical Considerations

The Liverpool John Moores University ethics committee granted ethical approval for this study. The online survey consisted of an information page that briefly described the study objectives. A link to a detailed information letter was included on the information page, which the participants were encouraged to read before consenting to participation. In addition to study details, the information letter also included contact details for various mental health organisations to encourage participants to seek support if they were experiencing any mental health issues or concerns. Participation in the study was voluntary, and answers to the survey were anonymous.

Procedures

Online survey data was collected between November 9th, 2018 and February 20th, 2019. A convenience sampling method was utilised to recruit athletes from various sports organisations and clubs in the UK. Potential gatekeepers were contacted, such as performance directors, coaches, and established members of sports clubs/organisations to assist in the recruitment of athletes. Finally, participants were also recruited through social media channels such as Twitter and LinkedIn. Potential participants received a link to the anonymous online survey, including an information page with all relevant information concerning the study.

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Statistical Analyses

To define clinically relevant symptoms of depression, a cut-off score of ≥ 10 was used (Kroenke & Spitzer, 2002; Manea et al., 2015). Logistic regression models with adjusted odds ratios and 95% confidence intervals were utilised to test other brooding and reflection profiles, as predictors of clinically relevant symptoms of depression. First, a median split was conducted to categorise athletes based on their responses to RRS-scale: high/low brooding and high/low reflection categories (coded as low=0, high=1, respectively). After this, a “vulnerability to depressive symptoms” variable was coded with four categories: “low = low brooding/low reflection”, “moderate = low brooding/high reflection”, high = high brooding/low reflection, and “very high = high brooding/high reflection”. For the logistic regression analyses, three dummy variables were coded in which athletes with a “low brooding/low reflection” profile served as the reference category (“0”) to the three remaining combinations (“1”). Hence, the first model included low vs moderate vulnerability, the second model low vs high vulnerability, and the third model low vs very high vulnerability groups. All models were controlled for gender and injury status. The analysis was conducted in IBM SPSS version 25.0.

Results

Prevalence and Severity of Symptoms

The collective prevalence rate for clinically relevant depressive symptoms in the sample was 19.9% (PHQ-9 ≥ 10). Injured athletes reported noticeably high rates of clinically relevant symptoms (31.1%), of which 14.8% reported moderate, 14.8% moderately severe and 1.6% severe symptoms.

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Of the female athletes reporting clinically relevant symptoms (30.6%), 15.7% reported moderate (PHQ-9= 10-14), 10.2% moderately severe (PHQ-9= 15-19), and 4.6% severe symptoms (PHQ-9= 20-27). In male athletes reporting clinically relevant symptoms (13.1%), 8.0% reported moderate, 3.4% moderately severe and 1.7% severe symptoms of depression.

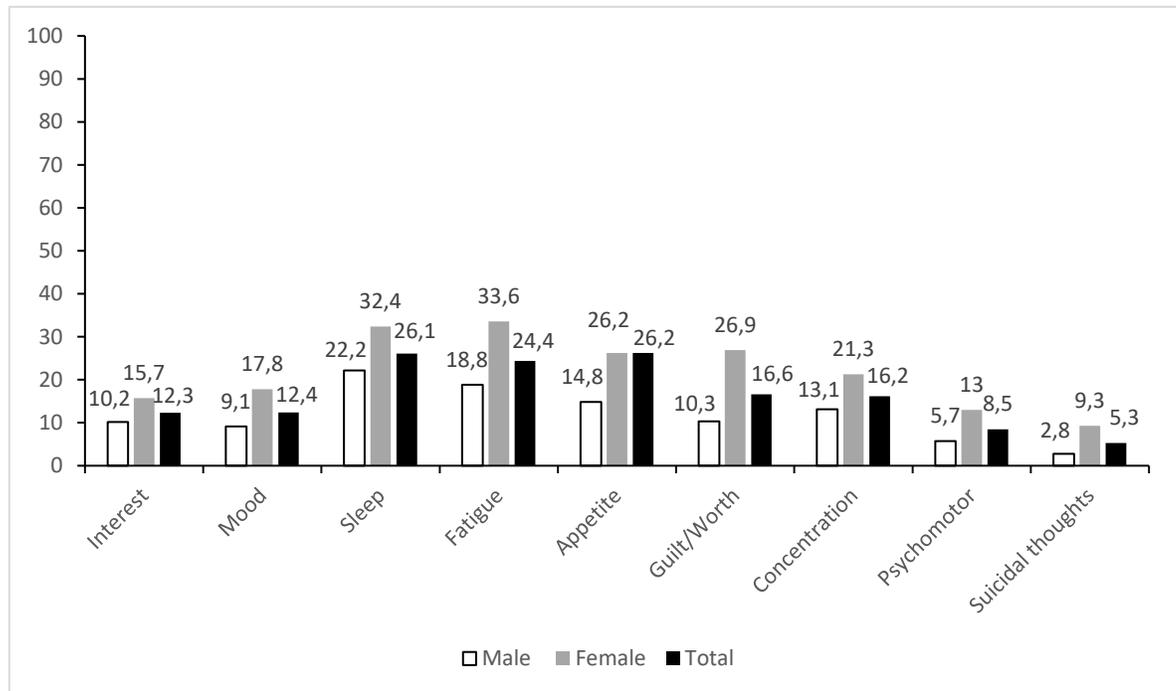
Exploring the prevalence of specific symptoms (symptom present at least most of the days within the past two weeks), it was found that the sample showed particularly high rates of sleep issues (26.1%), fatigue (24.4%), and issues with appetite (26.2%) (Figure 8). However, the core symptoms of depression showed considerably lower prevalence rates, lack of interest (12.3%) and depressed mood (12.4%). Chi-square analyses revealed that female athletes showed significantly higher prevalence of most depressive symptoms including; depressed mood ($p = .03$), fatigue ($p = .01$), appetite ($p = .02$), guilt/worth ($p = .001$), psychomotor ($p = .03$), and suicidal thoughts ($p = .02$). In male athletes, symptoms related to sleep (22.2%) and fatigue (18.8%) were most prevalent. In females, issues with sleep, fatigue, appetite, and guilt/worthlessness showed the highest rates (26.9% - 33.6%) (Figure 8).

Finally, the prevalence of the core symptoms of depression (lack of interest/depressed mood) was explored. It was shown that of the athletes that exhibited clinically significant depressive symptoms (PHQ-9 \geq 10), 29.8% did not exhibit either of the core symptoms, while 31.6% exhibited one, and 38.6% exhibited both core symptoms.

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Figure 8

Male, female, and total athlete sample prevalence of specific depressive symptoms



Mean Depression Symptom Scores

Table 11 presents athletes' gender distribution and sport-related characteristics along with mean scores for depressive symptoms. The only significant difference in mean depression scores across demographic variables were found between male and female athletes [$t(181.74) = -3.56, p < .001$]. Across sport-related factors, the only differences in mean depression symptom scores were between injured and non-injured athletes [$t(284) = 2.49, p = .013$]. Within the injured group, a significant difference was also evident in mean symptom scores between athletes with 20 days or less to recovery ($M=5.43, SD=3.80$) and those with more than 20 days to recovery ($M=8.80, SD=5.78$) [$t(50.92) = -2.67, p = .010$].

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Table 11

Mean depression symptom scores on the patient health questionnaire (phq-9) across selected sample characteristics

Factor	n	%	PHQ-9
			M (SD)
Gender			
Male	176	61.5	5.11 (4.49)*
Female	108	37.8	7.48 (5.93)
Type of sport			
Team	124	43.4	6.68 (5.53)
Individual	162	56.6	5.53 (4.96)
Current competitive level			
International/Top tier professional	87	30.4	6.45 (5.37)
Local/Regional/National	179	61.3	6.02 (5.27)
Currently injured			
Yes	61	21.3	7.49 (5.47)*
No	225	78.7	5.63 (5.11)
Estimated time to full recovery (injured)			
≤ 20 days	19	32.4	5.43 (3.78)*
> 20 days	40	67.8	8.80 (5.78)
Competitive season			
In-season	213	74.5	5.86 (5.13)
Off-season	73	25.5	6.53 (5.55)

Note. % refers to the percentage of the total sample within each factor, * p<.05

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Mean Brooding and Reflection Scores

Brooding rumination was significantly higher in female ($M=10.25$, $SD=3.80$) than male ($M=8.91$, $SD=3.20$) athletes, $t(191.45) = -3.01$, $p=.003$. Brooding was also significantly higher in athletes who were currently in their off-season ($M=10.43$, $SD= 3.90$) compared to athletes who were currently in-season ($M=9.03$, $SD=3.27$), $t(107.86) = -2.72$, $p=.008$. No other significant differences were found in brooding across participant characteristics. Reflective rumination was also significantly higher in female ($M=10.43$, $SD=3.57$) than male ($M=9.14$, $SD=3.05$) athletes, $t(270) = -3.17$, $p=.002$. In addition, reflective rumination scores were significantly higher in injured ($M=10.41$, $SD=3.66$) than non-injured athletes ($M=9.42$, $SD=3.18$), $t(272) = 2.04$, $p=.04$.

Brooding and Reflection Profiles and the Odds of Experiencing Clinically Relevant Depressive symptoms

As shown in Table 12, when compared to athletes with a low brooding and reflection profile, significantly higher odds of experiencing clinically relevant depressive symptoms were observed for athletes with a high brooding/low reflection profile ($OR=7.14$, $95\%CI=1.89-27.00$) and high brooding/reflection profile ($OR=15.24$, $95\%CI=4.37-53.24$). Athletes with a low brooding/high reflection profile did not have significantly higher odds of experiencing clinically relevant symptoms than the reference category.

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Table 12

Prevalence and odds ratios for clinically relevant depressive symptoms (phq-9 \geq 10)

relative to athletes' rumination profiles

Factor	%	n/N	OR (95% CI)
Rumination profiles (vulnerability)			
Low brooding/Low reflection (low)	3.5	3/86	1.0
Low brooding/High reflection (moderate)	9.1	4/44	4.25 (0.65 – 27.70)
High brooding/low reflection (high)	19.7	12/61	7.33 (1.93- 27.84) *
High brooding/High reflection (very high)	39.5	32/81	13.40 (3.81– 47.11) **

Note. % = within-group prevalence of clinically relevant depressive symptoms, n= frequency of cases, N=total sample size within (vulnerability) category. OR= Odds ratio, 95%CI= 95% confidence intervals. All analyses were adjusted for gender, age and injury status. *p<.005, **p<.001.

Discussion

In the current study, depressive rumination (i.e. brooding and reflection) as described in the Response Styles Theory was explored in a sample of competitive athletes. The study was specifically focused on testing the relationship between different brooding and reflective rumination profiles differentially predicted differences in the likelihood of exhibiting clinically relevant depressive symptoms. This theoretically informed study found support for the importance of brooding rumination in explaining the mechanism by which individual differences in depressive symptoms may emerge. Furthermore, the study replicate some of the findings concerning depressive symptom profiles of athletes explored

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in study two – underlining that issues with sleep and fatigue may be especially relevant symptoms in athletes.

Prevalence Rates and Mean Differences Across Sample Characteristics

Approximately one in five athletes (19.9%) reported clinically relevant symptoms of depression, with female athletes reporting a 30.6% and male athletes a 13.1% prevalence. The study adds to the rapidly growing evidence-base that demonstrates clinically relevant depressive symptoms in athletes and reports overall prevalence rates that are comparable with those found in some previous studies (e.g., Beable et al., 2017; Wolanin 2016). However, the overall prevalence rate was noticeably higher in the current study (19.9%) when compared to the rates observed in study two (8.1%) of this thesis. One explanation for these differences could lie in the overall differences in the representativeness of the sample. That is, in the current study athletes were recruited mainly through social media outlets whereas study two recruited athletes more systematically across the whole population of Icelandic adult athletes in co-operation with the national sport organizations. It is hence possible that response bias may have been more pronounced in this study when compared to the previous study two. Furthermore, while the current sample included athletes from 54 different sports including individual and team sport athletes, the sample in study two included athletes from three different team sport. Prevalence rates across sports may have been more variable in the current sample and hence, contributed to an overall higher prevalence rate. It should also be noted that study one focused on Icelandic athletes, and the athletes in the current study were mostly UK citizens. Hence findings need to be interpreted with the potential sampling-related and cultural influences in mind. The prevalence of specific symptoms was also considerably higher in the current sample when compared to the sample in study two. However, it is

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interesting to note that in both athlete samples (study 2 and 3), fatigue and sleep were more prevalent than the core symptoms of depression (lack of interest and depressed mood).

When the prevalence of core symptoms of depression were explored among athletes that exhibited clinically relevant symptom sum-scores ((PHQ-9 ≥ 10), approximately 30% of athletes did not exhibit either of these symptoms. In study two this prevalence rate was approximately 40%, suggesting that in the current sample, athletes scoring above the clinically significant cut-off score were more likely to exhibit either depressed mood or a lack of interest. This further supports notions made in the two previous studies in this thesis, that interpreting merely summed symptom scores may mask important information concerning symptoms that may be especially relevant in athletes.

The findings from the current study also support previously reported gender difference in athlete depression and reaffirm that female athletes show higher levels of depressive symptoms than their male counterparts (Gulliver et al., 2015; Yang et al., 2007; Wolanin 2016). The current findings were also in-line with findings from study two, suggesting that female athletes report overall higher symptoms of depression and this is reflected in differences across most of the specific underlying symptoms.

In terms of other determinants explored concerning depressive symptoms in the current study, injured athletes exhibited significantly higher levels of depressive symptoms than uninjured athletes. No significant differences across the other measured characteristics were observed, however. For example, and contrary to some other studies (Nixdorf et al., 2013, 2016; Schaal et al., 2011; Wolanin et al., 2016), no significant difference emerged between team and individual sport athletes. This finding could be due to the specific type of sports that were included (or not) in this study. For instance, in the current athlete sample, few athletes were competing in aesthetic sports. As discussed in previous research

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introduced in this thesis – female athletes in aesthetic sports showed the highest rates of clinical depression when compared to other sports (Schaal et al., 2011). Future studies could, therefore, explore whether differences between team and individual sports may be more accurately explained by specific sports (e.g., rugby vs figure skating) or types of sport (e.g., team ball sports vs aesthetic) rather than by the broad distinction alone. As shown in study two of this thesis, even when comparing team sports within the same cultural context (i.e., Iceland) significant differences emerged. This suggests that there may also be important specific risk factors embedded within the local sport context (e.g. coaching traditions) (Halldorsson et al., 2014; Rice et al., 2016).

Differences in Brooding and Reflective Rumination

It was found that brooding and reflection was significantly higher in female than in male athletes. This finding is in line with previous studies in non-athlete samples that have suggested that gender differences in depression may be partly explained by females' higher tendency to engage in rumination (Johnson & Whisman, 2013). Considering that cognitive vulnerability may become established in childhood or early adolescence (Mezulis et al., 2006) and that gender differences have shown to emerge in early adolescence (Hankin & Abramson, 2001; Salk et al., 2016) more research is needed to understand gender differences in athletes through potential differences in developmental trajectories in sport. It is also important to consider the potential broader socioeconomic forces that contribute to the development of gender differences (Nolen-Hoeksema, 2001). For example, females may be in general more likely than males to experience victimisation, and chronic strains due to their societal status and roles (Nolen-Hoeksema, 2001). Furthermore, additional stressors for female athletes may emerge from the context of sports where male sports are

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often portrayed as the norm, and female sports merely as secondary (Fink, 2015). This gender disparity between male and female athletes may for example present itself in the form of limited athletic opportunities or unequal pay for females (Archer & Prange, 2019).

Brooding was higher in off-season athletes when compared to in-season athletes. It is possible hence that for athletes in the current sample, the off-season was perceived as a stressors (Doherty et al., 2016), potentially increasing athletes engagement in brooding rumination. According to the response styles theory, depressive rumination is considered a stable trait, with brooding considered as a habitual response to negative mood (Watkins & Nolen-Hoeksema, 2014). This stability is, however, relative rather than absolute (Bagby et al., 2004) – meaning that while levels of brooding may fluctuate due to contextual influences (e.g. change in stressors), they do so in a predictable pattern over time (e.g. differences between high vs. low brooders remains despite fluctuations). It is therefore important for future studies to further explore the response styles theory by assessing athletes' levels of stress to determine whether athletes with high brooding tendencies exhibit higher increases in depressive symptoms than athletes with low brooding, when exposed to stress.

Exploring reflective rumination across sample characteristics, the only difference was found between injured and uninjured athletes. Specifically, injured athletes showed significantly higher tendencies to engage in reflective rumination than uninjured. As discussed by Roy et al. (2016), higher reflective rumination has been linked to a lower ability to shift attention between tasks. Perhaps, athletes with a higher tendency to engage in reflective rumination in the sample were more likely to be injured due to a decreased ability to switch focus, and consequently being less likely to react to or avoid situations that may lead to injury. On the other hand, it is also possible that injured athletes were more

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likely to engage in reflective rumination due to their injury. Reflective rumination has been described as a goal-oriented process in relation to a perceived goal-discrepancy (Nolen-Hoeksema et al., 2008). Hence, it is plausible that injury served as an active goal-discrepancy (recovery-injury) that influenced increased levels of reflective-rumination to deal with this discrepancy.

Brooding and Reflective Rumination in Relation to Depressive Symptoms

A particular focus of the current study was to deepen current knowledge of cognitive vulnerability concerning depressive symptoms in athletes. The study set out to test whether the odds of experiencing clinically relevant symptoms of depression differed depending on the athletes' tendency to engage in brooding and reflective rumination. Based on the response style theory and recent accounts of the adaptive (reflection) and maladaptive (brooding) forms of depressive rumination, it was expected that athletes with a high brooding and reflection profile would have higher odds of experiencing clinically relevant depressive symptoms when compared to athletes with low brooding and low reflection profile. This expectation was supported as athletes with a tendency to engage in high levels of brooding, and reflection had the highest odds of experiencing clinically relevant depressive symptoms. More specifically, in comparison to athletes with a low brooding/reflection profile, the odds of clinically relevant symptoms were seven-fold in athletes with high brooding but low reflection. For athletes with a high brooding and high reflection profile, however, the odds of clinically relevant symptoms were 15-fold. The findings are in line with studies conducted in non-athlete samples (Joormann et al., 2006; Treynor et al., 2003), suggesting that brooding represents a maladaptive process that has a

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significant impact on athletes' likelihood of experiencing clinically relevant depressive symptoms.

No specific hypotheses were set concerning how or whether reflection would relate to depressive symptoms. The results suggested that having a high tendency to engage in reflective rumination did not increase the odds of clinically relevant depressive symptoms when combined with a low tendency to brood. On the other hand, when combined with a *high* propensity to brood, reflection was linked to increased odds of depressive symptoms. These findings support the consensus among clinically oriented psychology researchers that the adaptiveness of reflection may be largely dependent on individuals' tendency to brood, in the way that engaging in brooding in response to negative mood may override the potential adaptive effects of reflection (Joormann et al., 2006). If reflection were indeed an adaptive trait for individuals, one would expect to see that a high tendency to reflect would attenuate the effects of brooding on depressive symptoms. This was, however, not the case in the current study; in fact, as mentioned previously, having a high reflection and brooding profile was related to the highest odds (OR=15). In line with this, the role of reflection as an adaptive trait has been challenged by Whitmer and Gotlib (2011). They showed that some reflection items loaded more on the brooding factor among currently depressed individuals. According to the authors, and in line with Treynor and colleagues (2003), it might be that reflective rumination has an adaptive function in non-depressed individuals, but a maladaptive function in depressed individuals. Future research could further investigate whether reflection could have an adaptive function through other outcomes, such as increased meaning in life and/or sport. This question could be explored in parallel to depression in the athlete population. Furthermore, as shown in previous studies, while reflective rumination may correlate with depressive symptoms concurrently, evidence

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suggests that only brooding, but not reflective rumination predicts depressive symptoms over time (Treyner et al., 2003)

Although the findings of this study suggested that brooding is related to an increased likelihood of athletes to exhibiting clinically significant depressive symptoms, this should be further explored in longitudinal research designs. Furthermore, although the the RRS-short form questionnaire assesses how individuals usually respond to depressed or negative mood, more objective data on mood fluctuations should be included in future research. If the influence of negative mood or stress on depressive symptoms vary depending on individual's ruminative tendency - stronger support for depressive rumination as an underlying cognitive mechanism could be established.

Limitations

The study findings should be interpreted with an understanding of its main limitations. Firstly, due to the cross-sectional study design, causal or temporal inferences cannot be concluded. Also, due to the convenience sampling methodology, self-selection bias may have influenced the findings. This study also had a broad range of different athletes in terms of the type and the level of sports. As sample sizes across different sports were not sufficiently large, more specific analyses to disentangle potential sport-specific effects was not possible. It is also important to note that the findings were limited to athletes from the United Kingdom, and hence, interpretations should be made with an understanding of this cultural specificity.

Despite these limitations, this study is an important addition to the mental health literature in sport psychology. It provides a theory-driven glance into the relationship between depressive rumination and depression symptomology in an athlete sample.

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Furthermore, the study responds to a call voiced by study one as well as other scholars in the field, to explore and validate cognitive vulnerability research in the athlete population. By doing this, the intention was to open new avenues to further understand depressive symptoms in the context of competitive sports, especially in terms of identifying the underlying mechanism by which individual differences in depressive symptoms may emerge. Finally, many of the previous studies have merely assessed overall depressive symptoms without exploring the underlying symptomology in more detail. Also, differences in depressive symptoms have often been explored across hypothesised predictors by comparing mean differences. However, mean difference analyses are not sensitive to the clinical relevance of the observed differences. Therefore, in addition to mean differences, this study also explored ratios of potential non-cases to cases (logistic regression models) across the different levels of the predictor variable.

Conclusions

The current study is an important addition to current literature on depressive symptoms in athletes. First it adds to findings observed in study two, underlying that fatigue and issues with sleep may be especially relevant symptoms in athletes, and that female athletes show higher prevalence than male athletes across a several symptoms. Furthermore, this study adds to our understanding of clinically significant symptomology in the current athlete sample, showing that approximately 1/3 of athletes did not exhibit either of the core symptoms of depression. As discussed in study one of this thesis, research on cognitive vulnerability in athletes has been scarce. Furthermore, studies on cognitive vulnerability have been fragmented, lacking systematic explorations to this important area of research. As reviewed in the background chapter of this thesis, it is likely that the

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stressors that trigger depression in athletes may often be linked to sport-specific determinants such as athletic failure, injury, or career termination (Appaneal et al., 2009; Hammond et al., 2013; Wippert & Wippert, 2008; Wolanin et al., 2015). Although the stressors may indeed revolve around sport-related themes, it is likely that the mechanism by which these stressors exert their effects on depressive symptoms would be similar to those observed in non-athlete samples. This study provides initial support for this notion and highlights the utility of exploring these mechanisms in athletes through the lens of the response styles theory.

While this study adds significantly to current knowledge - depressive rumination was explored cross-sectionally, and athletes' current levels of stress were not assessed. According to the response styles theory, differences in depressive rumination would be expected to predict increases in depressive symptoms over time. Furthermore, individuals who have higher brooding qualities would be expected to have more maladaptive responses to stress, and therefore being more vulnerable to experiencing elevated symptoms of depression. Considering that athletes may experience a range of different stressors (Howells & Fletcher, 2015; Moesch et al., 2018; Sarkar & Fletcher, 2014; Schinke, Stambulova, et al., 2018), even at times when athletes are not engaged in their sporting endeavours (Doherty et al., 2016; Nesti & Sewell, 1999) – the final study of this thesis aims to further validate the response styles theory by assessing the interaction between depressive rumination and perceived stress on depressive symptoms utilising a longitudinal research design.

Study 4 - The Bridge

In the previous three empirical studies of this thesis, several aspects of depressive symptoms in athletes were explored. In study one, it was underlined that further research is needed on cognitive vulnerability utilising prospective study designs. In study two, the findings suggested that exploring specific depressive symptoms, in addition to sum-scores, may be advantageous for providing a richer understanding of depressive symptoms that may be especially relevant in athletes. Study three built on the two previous studies in this thesis by exploring specific symptomology and reported similar findings to those reported in study two. Furthermore, as identified in study one, research on cognitive vulnerability in athletes has been lacking. Therefore, study three aimed to fill this gap by exploring brooding and reflective rumination as potential vulnerabilities to depressive symptomology. The findings highlighted the importance of brooding as an especially potent cognitive vulnerability factor in explaining why some athletes may be more likely to experience clinically significant depressive symptoms than others. It was, however, discussed that to provide stronger support for the response styles theory in athletes, it should be explored longitudinally to test whether the findings hold over time. Furthermore, an important aspect of understanding cognitive vulnerability is that when compared to less vulnerable individuals, vulnerable individuals may be especially likely to experience elevated depressive symptoms when levels of stress increase. In this final study of the thesis, the aim was therefore to further explore the response styles theory utilizing a longitudinal research design to test the relationship between depressive rumination and perceived stress on depressive symptoms over time.

**Depressive Symptoms in Icelandic Elite Athletes: A Prospective Examination
Through the Lens of the Response Styles Theory**

Perhaps the most explicit and defining feature of elite sports is the experience of losing and winning. While winning and losing in competition may be explicit events influencing mood – mood fluctuations may also emerge through more subtle events (e.g., having a good vs. poor day of training). While these types of events are inherent in sport, and perhaps commonly anticipated by athletes, they may nevertheless impact on athletes' mood and functioning for a significant period of time (Howells & Lucassen, 2018; Jones & Sheffield, 2007). Athletes are also exposed to a wide range of stressors throughout their athletic careers (Wolanin et al., 2015) – and competitive sports may therefore pose a unique environment in which mood fluctuations may be experienced on a regular basis. Subsequently, athletes with underlying cognitive vulnerabilities may be in a heightened risk for experiencing more severe distress than less vulnerable athletes (Nixdorf et al., 2020) when faced with stressful life-situations (Beable et al., 2017; Gerber et al., 2018).

Although a range of risk factors for depressive symptoms have been identified in athletes, most studies have consisted of cross-sectional data (Golding et al., 2020). Hence, the temporal relations between stressors and depressive symptoms remain largely untested in athletes. Also, as underlined in a recent study by Nixdorf et al. (2020), there is a lack of theoretically informed studies, and majority of research to-date has been descriptive - exploring risk factors that may be difficult to target in intervention (e.g., type of sport, age, or injury status). Hence, while previous research has increased our understanding of important stressors that correlate with depressive symptoms, there is less empirical

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evidence explaining the underlying mechanism by which these stressors exert their effects on depressive symptoms. Increasing knowledge of the potential underlying mechanisms that could explain individual differences in depressive symptoms, future applied work could more effectively target key determinants in athletes.

In one of the few studies that have utilised theory-driven approaches to studying depressive symptoms in athletes, Gerber et al. (2018) explored depressive symptoms and burnout in young elite athletes at two-time points 6 months apart. Their study was informed by the cognitive-transactional model of stress, which suggests that a mismatch between environmental demands and the individual's cognitive (coping) resources influences the level of distress an individual may experience. Gerber and colleagues (2018) found that perceived stress was significantly related to depressive symptoms, while mental toughness buffered these stress-related outcomes. Gerber et al. (2018) defined mental toughness as; 1) a tendency to engage in approach rather than avoidance behaviours to cope with challenges, 2) to see challenges as an opportunity to problem-solve, 3) to nurture personal growth, and 4) to embody an overall sense of ability to influence the course of outcomes in the face of adversity. Conceptually, mental toughness may hence depict individual characteristics largely opposite to those that define depressive, especially brooding rumination (e.g. avoidance rather than action-oriented behaviours). In another prospective study, Nixdorf et al. (2020) utilised the general diathesis (vulnerability) - stress model to predict depressive symptoms and burnout in junior athletes. Nixdorf and colleagues assessed athletes at three-time points, at pre-season, in-season, and at post-season. The strength of this prospective study was that diatheses or vulnerability factors were assessed at pre-season, stressors in-season, and outcomes at pre- and post-season, testing the temporal progression of

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relationships as postulated by the diathesis-stress model. Nixdorf and colleagues found that dysfunctional attitudes, (negative) coping strategies, and pre-season depressive symptoms significantly predicted depressive symptoms at post-season. It is interesting to note, however, that stress was not a significant predictor of depressive symptoms at post-season (time 3). It is however plausible that the effects of stress on depressive symptoms were not captured by Nixdorf and colleagues due to the time delay between stress assessment (T2) and the assessment of depressive symptoms (T3). Vulnerability-stress models of depression are inherently theories of stress-reactivity – explaining how stable individual differences in vulnerability (e.g. brooding) moderate the influence of stress exposure on depressive symptoms (Abela et al., 2012; Spasojević & Alloy, 2001). Therefore, to test a vulnerability-stress model of depression, it is important that stress is measured in parallel to symptoms of depression (Abela et al., 2012).

In study three of this thesis, findings suggested that athletes with high levels of brooding rumination were significantly more likely to exhibit clinically significant symptoms of depression than athletes with low levels of brooding. Furthermore, while reflective rumination was also correlated with clinically significant depressive symptoms, the effects of reflective rumination on depressive symptoms were only observed in conjunction with high, but not low, levels of brooding. While the findings suggested that brooding may be more strongly linked to elevated depressive symptoms than reflection, study three did not explore brooding and reflection over time. Furthermore, study three did not take into consideration that athletes may have experienced different levels of stress at the time of the study. The response styles theory postulates that individual differences in depressive rumination (vulnerability) predict depressive symptoms due to its effects on

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negative mood once it has been activated, but not necessarily when individuals are not experiencing negative mood (Nolen-Hoeksema et al., 2008). For example, two athletes could significantly differ in their overall tendency to ruminate and while during periods of low stress these athletes may not differ in their levels of depressive symptoms – during periods of high stress, the athlete with a high tendency to ruminate would be expected to exhibit higher increase in depressive symptoms than athlete with a low tendency to ruminate. Hence, according to the response styles theory the effect of stress on depressive symptoms would depend on (e.g. be moderated by) individuals' tendency to ruminate. As shown in recent prospective studies in adolescents (Abela et al., 2012; Mezulis et al., 2010; Paredes & Zumalde, 2015), brooding rumination has shown to moderate the effects of stress on depressive symptoms. For example, in a study by Bastin et al. (2015), brooding rumination measured at baseline (beginning of the study) moderated the prospective relationship between interpersonal stress and depressive symptoms in an adolescent sample.

In this final study of the thesis, the overarching goal was to build on findings from study three to further validate the response styles theory in a sample of Icelandic top-level athletes. It has been suggested that the optimal method for exploring and testing vulnerability-stress models is to sample data prospectively and to test hypotheses using multilevel modelling techniques (Abela et al., 2012; Bastin et al., 2015). One of the advantages of using multilevel modelling when testing theoretically informed hypotheses is that this approach allows researchers to disentangle the within- and between-individual effects (level 1 and level 2, respectively; Aguinis et al., 2013). For example, while the main effect of depressive rumination on depressive symptoms over time would reflect between individual differences (i.e. rumination as habit or trait), individual fluctuations in perceived

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stress across time (deviations from individuals' mean levels of stress) would represent a time-varying within-individual changes. This type of operationalisation also allows the researchers to explore potential cross-level interactions between traits (rumination) and states (perceived stress) on the outcome measure (depressive symptoms; Abela et al., 2012). Multilevel models are also beneficial as they do not require balanced data; that is, participants do not need to have the same amount of observations across the study period (Abela et al., 2012; Goldstein, 2003)

Therefore, the current study utilises multilevel modelling to test the longitudinal relationship between depressive rumination, perceived stress, and depressive symptoms through the lens of the response styles theory. In-line with the previous studies in this thesis, the first aim of this final study continues the path set forth in study two and three – exploring prevalence rates of clinically significant (sum-score) and specific depressive symptoms. The second aim was to test whether perceived stress over the study period (fluctuations around athletes' average score) contributes to differences in depressive symptoms over time (measured at each time point). As previous studies in non-athlete and athlete samples have suggested, it was hypothesised that increases in athletes' perceived stress level would significantly predict increases in depressive symptoms over the study period. The third aim of the study was to explore whether brooding and reflective rumination predicted differences in depressive symptoms over time. Based on previous empirical research, it was hypothesised that both brooding and reflection would be correlated with depressive symptoms when tested cross-sectionally, but only brooding would predict depressive symptoms over time. The fourth aim was to test the validity of the response styles theory. More specifically, the objective was to test whether the potential

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prospective relationship between stress and depressive symptoms was dependent on (moderated by) between-athlete differences in the tendency to brood and/or reflect as measured in the beginning of the study. As predicted by the response styles theory (Abela et al., 2012; Nolen-Hoeksema, 1991; Treynor et al., 2003; Watkins & Nolen-Hoeksema, 2014), it was hypothesised that increases in perceived stress scores would relate to significantly higher depressive symptom scores in athletes with high tendency to brood compared to athletes with a low tendency to brood.

Methods

Participants

To be included in the study, participants needed to have responses to rumination, stress, and depressive symptoms items at least at two points, including time 1 (T1) and at least one other occasion either at first or second follow-up (T2 and/or T3). A total of 79 elite and national team athletes were included in the study ($M= 23.5$, $SD=4.8$, age range 18-37), with the majority being female athletes ($n=60$, 75.9%). Athletes competed in handball ($n=22$, 27.8%), football ($n=14$, 17.7%), basketball ($n=26$, 32.9%), Icelandic equitation ($n=8$, 10.1%), and mixed martial arts and/or Brazilian jiu-jitsu (MMA/BJJ; $n=9$, 11.4%). Athletes in MMA/BJJ were all members of an elite competition group, and all other athletes were either members of the Icelandic junior (≥ 18 years old) ($n=33$, 41.8%) or the A-squad ($n=37$, 46.8%) national team at the beginning of the study (T1).

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Measures

Depressive Symptoms

Depressive symptoms were assessed by the Patient Health Questionnaire 9 (PHQ – 9; Kroenke & Spitzer, 2002), which assesses the presence of the nine depressive symptoms listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) during the past two weeks. Each item is scored on a range from 0 to 3, where 0 = “not at all”, 1 = “several days”, 2 = “more than half the days”, and 3 = “nearly every day”, with sum-scores ranging from 0 to 27. Kroenke and Spitzer (2002) suggested a cut-off score of ≥ 10 (at least moderate severity) for identifying individuals with clinically relevant symptoms. To offer more information concerning prevalence in the current sample (Manea et al., 2012), the prevalence of clinically significant symptoms were also reported utilising cut-offs ≥ 15 (at least moderately severe symptoms; Kroenke & Spitzer, 2002). Furthermore, the prevalence of specific symptoms were explored in addition to sum-scores as this may allow for a richer understanding of athletes symptomology (Fried et al., 2016; Fried & Nesse, 2015). For symptom-specific prevalence rates, each symptom was coded either “0” (symptom not present, raw score on item ≤ 1) or “1” (symptom present, raw score ≥ 2). The psychometric properties of PHQ-9 have shown to be good among the clinical (Kroenke & Spitzer, 2002) and the general populations (Martin et al., 2006), including the Icelandic population (Palsdottir, 2007). The internal consistency of the scale across time points in the current sample was $\alpha=.68$ (T1), $\alpha=.78$ (T2), and $\alpha=.79$ (T3).

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Perceived Stress

The 4-item perceived stress scale is an adaptation of the original 14-item stress scale (PSS; Cohen et al., 1983). The scale assesses individuals' appraisal of feelings and thoughts of stress within the past month, for example; "In the last month, how often have you felt that you were unable to control the important things in your life?" or "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?". In its core, the scale was built upon the assumption that stressors have a negative influence on individuals when they are interpreted as threatening or demanding, and when available coping resources may not be perceived adequate (Cohen et al., 1983). The scale is scored from 0=never to 4=very often. Cohen et al. (1983) reported internal consistency of the PSS-4, which was $\alpha=.72$, and the test-retest reliability over two months was $\alpha=.55$. The internal consistency of the scale across the 6-month intervals in the current sample was $\alpha=.57$ (T1), $\alpha=.49$ (T2), and $\alpha=.56$ (T3).

Depressive Rumination

Ruminative Responses Scale - short form (RRS-short form) was utilised to assess brooding and reflective rumination. This version of the RRS is a 10-item scale adapted from the original 22-item RRS to measure rumination in response to depressed or negative mood (Treyner et al., 2003). The 10-items in the RRS-short form consist of five reflective pondering (reflection) items, such as "Analyse recent events to try to understand why you are depressed", and five brooding items, such as "Think why do I have problems other people do not have?". Respondents rate each of the 10 items in the questionnaire from 1 (almost never) to 4 (almost always), with higher scores representing higher tendency to

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engage in reflective and brooding rumination when feeling low, sad or depressed. The internal consistency of the scales in the current sample were $\alpha = .80$ for brooding and $\alpha = .70$ for reflection.

Procedures and Ethical Considerations

Recruitment of participant was conducted within an ongoing project at the department of Sport Science at Reykjavik University, Iceland. The ongoing project was a collaboration between Reykjavik University and selected national sports associations, where psychological skills and physiological assessments were conducted with national teams bi-annually. For the current longitudinal study, questions concerning mental health issues were added to the existing survey (which had previously only assessed psychological skills in sport). Athletes were informed about this addition and asked for separate informed consent to answer the mental health module of the survey. The PhD candidate also recorded and shared a video with potential participants, in which he explained the purpose of the research. Permission for the study was obtained from the National Bioethics Committee in Iceland (application number: VSNb2018050001/03.01) and the Icelandic Data Protection Authority.

Only athletes 18 years and older were included in the current study. Athletes were informed that individual data relating to the mental health survey would only be available for the principal investigators of this study and would not be shared with coaches or other staff. It was also underlined that answering the mental health module was voluntary and that athletes could withdraw from the study at any time. Athletes were informed that all personal information would be coded by key-linking ID numbers and that any personal

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identifiers would be omitted once data collection had been finalised. Hence, any data sets that were utilised for further analysis would not contain any information that could be traced to the individual athlete. Participants were also provided with contact information for psychological support and encouraged to seek help if they were experiencing any type of distress. Participants did not receive any form of compensation for their participation.

The first assessment (T1) was conducted at the time when teams participated in their on-site assessment within the larger ongoing project. Therefore, athletes from different sports initiated the study at different times. However, all athlete responses were acquired in late fall or winter months with 39.2% initiating in September-November and 60.8% of athletes initiating in January-March (during years 2018 and 2019). The follow-up surveys were conducted six months (T2) and 12 months (T3) following the initial assessment. A link to the follow-up survey was sent via personalised emails directly to each athlete. Athletes were also informed about the follow-up assessments through gatekeepers that had been involved with the national teams. Approximately two and four weeks after the initial emails were sent, email reminders were sent to athletes who had not responded to the survey. Each reminder highlighted the ethical aspects concerning participation and data collection mentioned previously.

Statistical analyses and Multilevel Models

First, a missing values analysis was conducted to explore any potential systematic patterns across all study variables. The Little's test of Missing Completely at Random (MCAR) was non-significant [$\chi^2(986) = 509.28, p = 1.00$], suggesting that data were missing completely at random. Across all time points, athletes with one missing response

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on the PHQ-9, PSS, and rumination scales were included in the analyses by averaging the scores on the non-missing items and multiplying this by the total number of items on the scale (Schafer & Graham, 2002). For example, for athletes with one missing item on the PHQ-9 scale, the mean of the eight non-missing items was multiplied by 9 (Löwe et al., 2006). Three athletes had one missing item on the PHQ-9 scale, one athlete had one missing item on the PSS scale, six athletes had one missing item on reflective rumination, and one athlete had one missing item on brooding rumination. All remaining missing values were due to participant drop-out at a specific time point. Considering the MCAR results and the ability of multilevel analyses to handle unbalanced data (Abela et al., 2012), including athletes with one missing time point (either T2 or T3) was not expected to bias the results of the main analyses (Field, 2013).

Main analyses testing the contribution of brooding and reflective rumination and stress on depressive symptoms, and the vulnerability-stress model (i.e., rumination-stress-depressive symptoms) over time, were conducted in SPSS through the “mixed” function. Multilevel modelling allows for testing the main and interaction effects of stable between-individual characteristics (level two factors) and time-varying within-individual covariates (level 1 factors) on the dependent variable (Abela et al., 2012; Aguinis et al., 2013; Bastin et al., 2015; Cox et al., 2012; Paredes & Zumalde, 2015). Brooding and reflection were included as continuous, between-subject predictors (level 2) with scores reported at T1 held constant across time T2 and T3. These between-subject predictors were grand-mean-centred (individual scores deducted from the sample mean) while perceived stress scores (level 1) at each time point were mean centred by deducting each athletes’ average stress score, rather than the group average, from athletes’ stress score at each specific time point.

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By centring brooding and reflection concerning individual differences, and by centring stress scores around the athletes' average level of stress - predictors were operationalised to fit the specific aims of the current study. That is, to test the cross-level interaction effects between individual differences (vulnerability) and within-individual change (stress) on the outcome over time (depressive symptoms; Bell et al., 2018).

Multilevel models were conducted utilising maximum likelihood estimates. The heterogeneous first-order autoregressive (ARH1) covariance structure was chosen for repeated measurements and random-effects models to allow for heterogeneous variances and correlated observations across adjacent time points (Field, 2013). In building the models, a random effects model for time at the level of the athlete was included. This inclusion allowed for between-participant differences in depressive symptoms to be accounted for at time T1 (random intercept) and over the study period (random slope).

Results

Descriptive statistics

As shown in Figure 9, the overall prevalence of clinically significant depressive symptoms was 5.1% at T1, 9.0% at T2, and 10.2% at T3 when imposing a cut-off score of ≥ 10 (at least moderate symptomology). When a cut-off score of ≥ 15 was utilised, the prevalence was zero at T1 and T2 and 1.7% at T3. A more detailed examination of the prevalence of specific depressive symptoms (symptom present at least most of the days in the past two weeks) showed that the core features of depression, depressed mood and lack of interest, were at their highest at T2 (7.5% for mood and 10.4% lack of interest), but were generally low across other time points (3.4% - 5.1%). Fatigue and sleep problems showed the highest prevalence rates of all symptoms, with fatigue ranging from 19.4% to 27.1% and sleep problems from 9.0% to 13.6% across the time points. It is also interesting to note that sleep and fatigue varied in similar patterns across the three time points, being lowest at T2 and highest at T3. Symptoms related to appetite, concentration, and guilt/self-worth followed a different (but similar in relation to each other) pattern across the time points, showing a positive linear increase from T1 to T3. A positive linear increase from T1 to T3 was also observed for summed symptom scores (Figure 9).

Core symptoms of depression were explored within athletes who scored above the clinically significant symptoms cut-off (PHQ-9 ≥ 10). At T1 and T3, 50% of athletes did not exhibit either of the core symptoms. At T2, none of the athletes with clinically relevant symptoms exhibited the core symptoms of depression.

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Figure 9

Sum-score prevalence and prevalence rates for specific depressive symptoms across time points three-wave study period

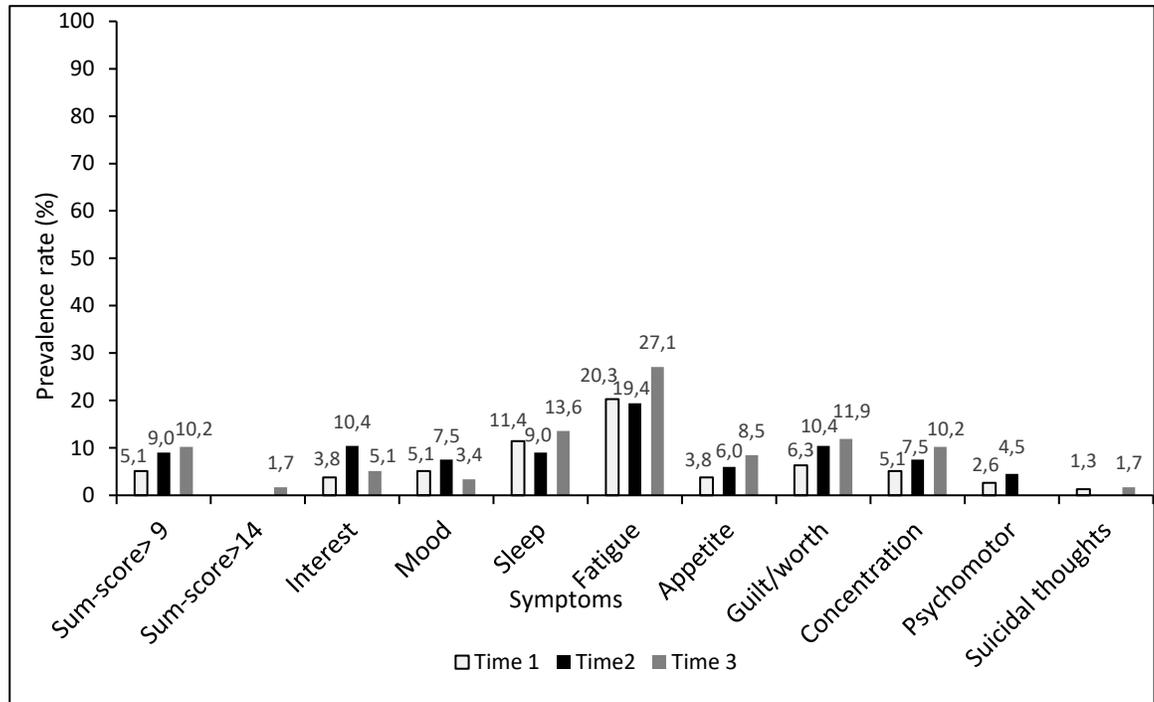


Table 13 shows the correlations, means and standard deviations across the study variables. Female athletes showed higher perceived stress than male athletes at T3 ($r = .28$, $p < .05$) and junior national team athletes showed a higher tendency to brood than A-national team athletes ($r = -.27$, $p < .05$). Apart from the correlation between reflective rumination and depressive symptoms at T3, brooding and reflective rumination, perceived stress, and depressive symptoms were positively intercorrelated at all time points.

Independent samples t-test showed no significant differences in brooding, reflection, or stress at T1 between male and female athletes. Junior national team athletes ($M = 9.1$, $SD = 2.8$) had significantly higher brooding scores than A-national team athletes

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($M = 7.7$, $SD = 2.3$) [$t(77) = 2.4$, $p = .02$], but did not significantly differ on reflection, stress or depressive symptoms.

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Table 13

Correlations between Study Variables, Means and Standard Deviations

	1	2	3	4	5	6	7	8	9	10	11
1 Age	-										
2 Sex	.24*	-									
3 National team	.55**	.24*	-								
4 Depressive symptoms (T1)	-.04	.05	-.18	-							
5 Depressive symptoms (T2)	.04	.13	.05	.53**	-						
6 Depressive symptoms (T3)	-.01	.22	-.20	.73**	.70**	-					
7 Perceived stress T1)	-.09	.08	.02	.57**	.44**	.56**	-				
8 Perceived stress(T2)	-.11	.02	-.06	.38**	.63**	.33*	.38**	-			
9 Perceived stress (T3)	-.09	.28*	-.12	.45**	.43**	.55**	.65**	.42**	-		
10 Brooding rumination (T1)	-.20	-.09	-.27*	.61**	.49**	.54**	.57**	.40**	.39**	-	
11 Reflective rumination (T1)	-.03	.05	.01	.33**	.42**	.26	.27*	.29*	.30*	.48**	-
M	23.46	-	-	4.02	4.73	5.07	4.94	5.09	4.97	8.28	8.10
SD	4.82	-	-	2.98	3.43	3.78	2.68	2.53	2.82	2.63	2.60

Note. Sex coded as 0=male and 1=female, National Team coded as 0=junior national team and 1=A-national team.

*Correlation significant at the $p < .05$ level. ** Correlation significant at the $p < .01$ level.

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Main effect of Time and Perceived Stress

Before conducting the main analyses, demographic factors (age, sex, type of sport and national team) were tested for main effects on depressive symptoms. However, none of these factors showed a significant relationship with depressive symptoms over time and hence, were not included in further analyses. As can be seen in Table 14, model 1 included random effects to account for individual differences in depressive symptoms at T1 (intercept) as well as over the study period (slope). Depressive symptoms scores at T1 (intercept) varied significantly across athletes. However, the trajectory of depressive symptoms across the study period (slope) did not significantly vary across athletes. Hence, while athletes varied in their depressive symptom scores at T1 changes in mean symptom scores during the study period did not significantly differ between athletes. Fixed effects model 1 showed that perceived stress ($b=.38$, $t=4.42$, $p<.001$) and time ($b=.43$, $t=2.54$, $p=.01$) independently contributed to differences in depressive symptoms over the study period. Hence, there was an overall mean increase in depressive symptoms in the sample over the study period. Also, an increase in athletes' perceived stress (changes in each athlete's mean stress levels) was related to an increase in depressive symptom scores.

Table 14*Fixed and Random Effects Models Predicting Depressive Symptoms across the Study**Period*

Fixed effect	Model 1			Model 2		
	b	SE	95% CI	b	SE	95% CI
Time	.43	.17	.09-.76**	.48	.17	.15-.81**
Perceived stress	.38	.09	.21-.55***	.34	.09	.16-.51***
Brooding	-	-	-	.66	.10	.47-.85***
Brooding*stress	-	-	-	.07	.03	.01-.13*
Random effect	Variance	SE	Z value	Variance	SE	Z value
Intercept	6.09	2.23	2.73**	3.50	.93	3.78***
Slope	1.05	1.11	.95	-	-	-
Intercept + slope (covariance)	.21	.63	.33	-	-	-
Model fit statistics	-2 Log		AIC	-2 Log		AIC
	959.90		979.90	927.16		947.16

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, b= regression coefficient, SE= standard error, CI= confidence interval, -2 Log = log likelihood, AIC=Akaike's Information Criterion.

Brooding and Reflective Rumination and Interaction with Perceived Stress

Considering that variance in depressive symptom trajectories during the study period (random slope) did not significantly differ between athletes in model 1, the random slope was not included in model 2 (Table 14). Furthermore, when brooding and reflective rumination were included as fixed factors, reflective rumination did not significantly explain variance in depressive symptoms over time ($b=.14$, $t=1.29$, $p=.20$). Therefore, reflective rumination was not included in the final model (model 2). As can be seen in Table 14, the random intercept remained significant in model 2, but variance was noticeably attenuated compared to model 1 (i.e., Model 1 variance= 6.09, model 2 variance = 3.50). This finding suggests that some of the random error variances in depressive symptom scores across athletes at T1 were explained by the addition of brooding

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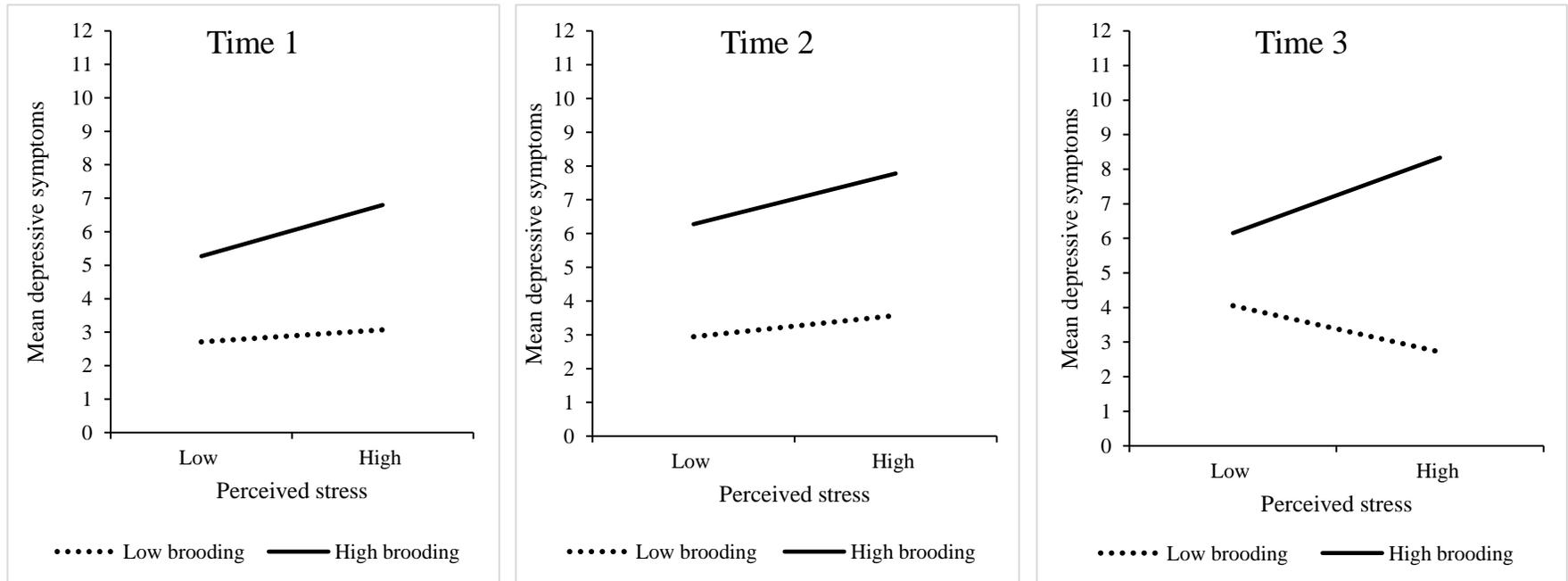
rumination and perceived stress in model 2. There was a significant interaction effect between brooding scores measured at T1 and fluctuations in athletes' perceived stress scores on depressive symptoms ($b=.06$, $t=2.15$, $p=.03$). This finding suggested that the positive relationship between perceived stress and depressive symptoms (change in perceived stress relates to change in depressive symptoms), was different depending on (moderated by) athletes' brooding scores measured at T1.

To better understand this interaction effect across time, univariate analyses were conducted separately for each time point (i.e. T1, T2, and T3). Athletes were dichotomised into high vs. low brooding groups based on median sample score on brooding rumination. Athletes were further categorised into two groups based on their perceived stress at each time point (high stress=score above athletes' average stress score, low stress=score at or below athletes' average score). There was a trend towards a higher increase in depressive symptoms for athletes with high brooding compared to athletes with low brooding when stress increased (Figure 10). However, while the main effect of brooding on depressive symptoms was significant both at T1 [$F(1, 73) = 27.8$, $p < .001$, adjusted $R^2=.27$] and T2 [$F(1, 62) = 23.3$, $p < .001$, adjusted $R^2=.24$], the interactions between brooding and stress were non-significant. This suggests that athletes with high brooding tendency exhibited consistently higher depressive symptom scores at T1 and T2 independent of current levels of stress. However, there was a significant interaction effect between brooding and stress scores at time 3 [$F(1, 54) = 4.0$, $p = .50$, adjusted $R^2=.25$]. This finding indicated that at time 3 when perceived stress was low athletes with high and low tendency to brood reported similar levels of depressive symptoms. However, when perceived stress was high, athletes with a high tendency to brood reported higher depressive symptom scores than athletes with low tendency to brood.

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Figure 10

Univariate tests of main and interaction effects on depressive symptoms between high/low-brooding and high/low-stress groups across time 1, time 2, and time 3



Discussion

Depressive rumination has been identified as a central cognitive vulnerability factor in the onset (Just & Alloy, 1997; Nolen-Hoeksema, 2000), maintenance (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 1997; Spasojević & Alloy, 2001), and recurrence of depression and depression symptomology (Michalak et al., 2011). However, as has been discussed through-out this thesis, longitudinal investigations especially in relation to cognitive vulnerability have been largely non-existent. In study three in this thesis provided preliminary, cross-sectional, findings of the relevance of exploring depressive symptoms through the lens of the response styles theory. In this final study of the thesis the response styles theory was further tested longitudinally by examining the relationship between depressive rumination, perceived stress and depressive symptoms. Furthermore, linking to previous studies in this thesis, overall prevalence rates, and prevalence of specific symptomology in the sample were also explored.

Prevalence of Clinically Significant and Specific Symptoms of Depression

The findings in the current study suggest that while moderate levels of depressive symptoms ranged from 5.1% to 10.2% across the study period, the prevalence of more severe symptomology (at least moderately severe symptoms PHQ-9 ≥ 15) was zero at T1 and 2, and only 1.7% at T3. In terms of more specific symptomology, depressed mood and lack of interest (cardinal symptoms of depression) were relatively low ranging from 3.8% to 7.5% across the study period (with the exception of decreased interest which was 10.4% at T2). It is also interesting to note that within athletes who scored above the summed clinical cut-off score of ≥ 10 , 50% of athletes did not exhibit core symptoms of depression

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at T1 and T3, and none of the athletes exhibited the core symptoms at T2. These rates differ from rates observed in study two and three (37.5% and 29.8%, respectively) and shows that clinically relevant depressive symptom sum-scores in top-level athletes may reflect issues relating to sleep or fatigue, rather than issues with depressed mood or a lack of interest. It should, however, be noted that the sample size was much smaller in the current study than the sample sizes in studies one and two and should therefore be interpreted with this limitation in mind. Nevertheless, the findings are interesting and should be further explored in future studies. If these findings hold, it would implicate that current screening tools may lead to a high rate of false positive cases in top-level athletes, further highlighting the need for the assessment of specific symptomology in addition to sum-scores, especially when depressive symptoms are assessed in this athlete population.

Issues with sleep and fatigue were the most prevalent symptoms in the sample, with fatigue ranging from 19-27% across the time points. This is an interesting finding, showing that issues with sleep and fatigue seem to be consistently most prevalent across the different samples in this thesis. It is also interesting to note that although the overall prevalence rates (when using a cut-off score of 10) were relatively low in the current study among top-level athletes – the prevalence of fatigue ranged between approximately 20-27%. Furthermore, sleep and fatigue showed similar changes in prevalence across the time points, while appetite, worthlessness/guilt, and concentration all varied in similar patterns across time points. This trend suggests that some symptoms may be more closely interlinked than others – when there is a change in issues of sleep, similar changes in fatigue may emerge. As discussed in study three, there may be similar physiological markers underlying these symptoms – and hence, future research in athlete depression may benefit from further

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exploring this topic. In sum, the findings highlight that depressive symptomology may show specific patterns in athletes, potentially due to the sport-specific demands that are imposed on this population. Future depression-related research in athletes would benefit from exploring the underlying symptoms more specifically to determine whether physiological symptoms could increase the risk for later mood-related issues in athletes or whether these physical symptoms are merely short-lived states due to specific athletic demands. The findings in this study suggests that issues such as fatigue are not, however, only short-term issues, as fatigue remained highly prevalent through-out the 12-month study period.

Perceived stress and Depressive Symptoms

It was found that increases in athletes' perceived stress, when operationalised as changes concerning athletes' average stress score, was related to higher depressive symptom scores over the study period. This finding is in line with some previous studies in athletes (Beable et al., 2017; Gerber et al., 2018) suggesting that levels of perceived stress or daily life-stress (Beable et al., 2017) are related to increased levels of depressive symptoms. Hence, although stress is inherent in competitive sports at the highest level, there may be a need identify and target “unnecessary” stressors as an early prevention strategy when optimising mental health in athletes (Purcell et al., 2019). For example, Beable et al. (2017) found that negative thoughts about the future and worry about meeting high standards were the most prevalent life stressors in athletes' lives. This finding suggests that while interventions aiming to help athletes to deal with worry or stress are important, in some situations the source of stress may systematically emanate from the athletes' proximal

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environment (e.g. pressure from parents/coaches) or the larger sports ecology (e.g., gender inequality). This would implicate that interventions targeting only individual athletes may not be sufficient and more multilevel approaches to prevention may be needed (Purcell et al., 2019).

Brooding, Reflection, and Depressive Symptoms

It was found that while both reflective and brooding rumination were correlated with depressive symptoms at T1, only brooding predicted depressive symptoms across the study period. This finding is in line with findings reported in study three of this thesis, which suggested that brooding was more strongly linked to concurrent depressive symptoms. The findings from study three and four also echo findings from non-athlete samples that have underlined that although both types of rumination correlate with concurrent depression, only brooding predicts depressive symptoms over time (Treyner et al., 2003). As a recent study by Ólafsson et al. (2020) suggested - and as proposed by the habit-goal framework of depressive rumination (Watkins & Nolen-Hoeksema, 2014) - brooding may entail stable and highly habituated cognitive processes that may be activated by negative mood or distress. For example, it has been suggested that engaging in brooding rumination is initiated automatically, without effortful control (Watkins & Baracaia, 2002). It thus functions as a rigid and reflexive cognitive system that may be primed before more conscious or goal-directed processes can be implemented. This habitual process may, hence, underlie the notion that individuals with a high tendency to engage in depressive rumination when experiencing negative mood show impaired problem solving (Donaldson & Lam, 2004; Nolen-Hoeksema et al., 2008). Subsequently, once initiated, disengaging

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from ruminative processes may be difficult (Koster et al., 2011), therefore increasing the risk for the onset of more severe and recurrent distress such as depression. Considering that attentional processes may represent the building blocks of athletic performance (Bennett et al., 2016; Swann et al., 2017), and that brooding has been implicated as transdiagnostic process predicting not only depression, but also a range of other psychological disorders (Watkins, 2009); brooding may represent an important target for intervention and prevention when the goal is to optimise both mental health and performance in athletes. As noted by Kröhler & Berti (2019), although the influence of rumination on athletic performance has often been discussed in the athlete literature, it has rarely been tested empirically – the findings from this study hence provides novel and important knowledge that future research can build upon.

Brooding, Perceived Stress, and Depressive Symptoms

It was found that brooding rumination moderated the relationship between perceived stress and depressive symptoms across the study period. When each time point was examined separately, there was a trend towards moderation at T1 and T2 and a statistically significant relationship at T3. These findings therefore indicate that athletes who develop a habitual tendency to brood may be more likely to exhibit elevated depressive symptoms when they experience increases in stress. These findings have important implications intervention and prevention initiatives in athletes. The context of competitive sports, especially at the elite-level is inherently stressful. Stressors may emanate from the context of sports (Wolanin et al., 2015) or from non-sport contexts (Beable et al., 2017; Doherty et al., 2016), and may significantly influence athletes' mood

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(Howells & Lucassen, 2018; Jones & Sheffield, 2007). Hence, athletes who develop a brooding tendency may often be faced with situations that increase the likelihood of experiencing elevated depressive symptoms. The current study elaborates on findings from study three and shows the potential utility of targeting brooding tendencies to attenuate the harmful effects of stress on depressive symptoms.

The findings from current study implicates that while athletes may be a unique population in terms of the stressors they are exposed to, the mechanism by which individual differences in depressive symptoms emerge may be the same as identified in non-athlete samples. The question is, however, how do these differences in athletes' tendency to brood emerge? It has been suggested that the development of a ruminative response style has shown to be linked with highly critical parenting styles (Spasojevic & Alloy, 2002), frequent negative reinforcement and punishment, and inconsistent and manipulative adult behaviours (Shaw et al., 2019), and when individuals are socialised through environments where expression of thoughts and opinions may be restricted (Watkins, 2016). These contextual risk factors are believed to contribute to the development of a generalised sense of helplessness in the face of adversity and distress, and consequently, children develop a tendency to engage in passive and self-focused coping (Nolen-Hoeksema, 1991; Shaw et al., 2019). It is possible that these types risk factors may be more prevalent in some sport context, increasing the risk for developing brooding rumination as a habitual response style to distress. While the current study did not explore these specific questions, it highlights the validity of applying the response styles theory to better understand why some athletes may be more susceptible to experiencing more severe depressive symptoms than others. Therefore, future research would benefit from exploring the developmental antecedents of

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brooding rumination in athlete samples, to determine whether developmental trajectories within sports contribute to the development of depressive rumination, over and beyond influences from non-sport contexts.

Limitations

There are several limitations to the current study that should be noted. First, due to the different athletic schedules, it was not possible to recruit all athletes into the study at the same time; hence potential contextual influences (e.g. timing of the season) could not be explored. The small sample size across different sports also did not lend themselves for comparisons of more specific sport-specific determinants. Also, although the multilevel strategy is flexible in terms of the inclusion of athletes with missing data points, the relatively small sample size may have contributed to less accurate estimates of standard error variances and hence, the observed confidence intervals may have been underestimated (Maas & Hox, 2005). However, the current study aimed at making preliminary interpretations of the validity of the vulnerability-stress account of response styles theory in the current sample, rather than to generalise more broadly to the Icelandic athlete population. Also, depressive symptoms at time 1 were not specifically controlled for in the analyses. Controlling for initial levels of depressive symptoms would have meant that all T1 data would have been excluded from models and analyses would have been constrained to two data point (T2 and T3). This controlling would have also meant that athletes responding only at time 1 and 2 would not have been included in the study (only one data point after exclusion of T1 data). However, a random effects model was included to allow for individual variation in depressive symptoms at T1. Although this does not specifically

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control for the effect of T1 depressive symptoms, it does account for different “starting points” in depressive symptoms when estimating individual variation in slopes. The sample was also uneven in terms of sex distribution, and most male athletes were junior athletes. However, the female athletes were mostly top-level A-squad national team athletes, and hence this allows for interpretation of the findings in this context. It should also be noted that the main aim of this study was to explore the validity of the response styles theory in an elite athlete sample concerning the relationship between brooding, stress and depressive symptoms. Hence, whether brooding predicted clinically significant levels of depressive symptoms was not tested. This would have been statistically challenging considering the low overall prevalence rate of clinically significant symptoms in the sample. Despite these limitations, the current study is an important addition to the existing athlete mental health literature, which has lacked theory-driven prospective studies which were designed to understand better potential underlying mechanisms in individual differences in depressive symptoms in athletes.

Conclusions

The final study of this thesis further supported the importance of exploring specific symptoms of depression in athletes. In-line with study two and three there may be several athletes that score above clinical cut-off scores, without exhibiting the core symptoms of depression. This further underlines the importance of exploring assessment related issues that were identified as a major gap in the literature by study one. Furthermore, the current study provides important, theoretically informed empirical support for the utility of exploring cognitive vulnerability to depression through the lens of the response styles

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theory. The findings suggested that elite-athletes who develop a tendency to brood in response to negative mood, may be in a significant risk for experiencing elevated depressive symptoms under stressful life situations. In addition to finding further support for the findings in this thesis, future studies would benefit from exploring the developmental antecedents of brooding rumination in athletes. This would allow for future prevention initiatives to better target relevant contextual factors that may contribute to the development of athletes' vulnerability to depression.

CHAPTER 4: General Discussion

Summary

Depression is one of the leading causes of non-fatal health loss in the world (James et al., 2018). An estimated 4-6 % of the world's population is currently living with depression (World Health Organization, 2017), and approximately 16% will meet criteria for a major depressive disorder during their lifetime (American Psychiatric Association, 2013). Within the past decade, awareness of athlete mental health issues and corresponding recognition of the importance of athlete welfare has occupied an increasingly important space in sport psychology literature and discourse (Gouttebauge et al., 2019; Moesch et al., 2018; Schinke, Stambulova, et al., 2018). Within this rapidly increasing area of sport psychology research, exploration of the prevalence and corresponding risk factors of depressive symptoms has been central (MacIntyre et al., 2017). While significant strides have been made in the past decade to increase the research output on depression in athletes, several gaps in the literature were identified in the first study of this thesis. Here, the main contributions of this thesis to knowledge advancement in the field are summarized. Thereafter, applied implications and future research directions are discussed.

Although several literature reviews in relation to depressive symptoms in athletes exists, several studies have not been included in these reviews due to their relatively stringent inclusion and exclusion criteria. Hence, in the first study of this thesis the aim was to explore more comprehensively the overall research output within the field to explore methodological trends and the topics that have been at the forefront of previous research. In this review, several gaps in the literature were identified that warranted more scholarly attention. Three main gaps were in specific focus in this thesis. First, there is currently a paucity of evidence of the psychometric properties of screening tools in athlete samples,

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potentially complicating the interpretation of result acquired from these measures.

Considering that athletes are also a specific population in terms of the physical load to which they are exposed to, there may specific symptoms that may be especially relevant in this population. Hence exploring athletes' specific symptom profiles were identified as an important topic for further investigation in this thesis. Second, although research has identified several risk factors related to depressive symptoms in athletes, there is little evidence concerning the underlying mechanisms that may explain differences in athletes' susceptibility to depressive symptoms. Therefore, a major theme in this thesis was to explore cognitive vulnerability to depression. Third, most studies in the literature to date have been cross-sectional and hence, there is still a large gap in our understanding of the temporal relationships between risk factors and depressive symptoms in athletes. Hence, in the final study of this thesis, cognitive vulnerability to depressive symptoms was explored utilising a longitudinal research design.

Contribution to Knowledge Advancement in the field

Understanding specific symptoms of depression

Previous studies in non-athletes has noted that there may be an inherent disadvantage in interpreting questionnaire data solely based on sum-scores, as these scores may mask important information of the underlying symptomology (Fried et al., 2014; Ingram et al., 2015; Moriarity & Alloy, 2020). Consequently, if the interpretation of findings are solely based on sum-scores, research conclusions could in some cases turn out to be "...as inadequate as the count of broken bones in a trauma victim" (Fried & Nesse,

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2015a, pp., 6-7). The point is, if symptoms are merely explored and interpreted based on an overall symptom score, it provides little information about the type of symptoms athletes may be dealing with. Why is it important to know more about specific symptoms? For one, as the research is interested in understanding depressive symptoms specifically in athletes, a logical place to search these answers would be to explore the specific symptom profiles – can we see some interesting patterns across athletes? This thesis suggests yes – but further research is needed to understand whether these patterns are indeed athlete specific or are issues with sleep, fatigue, and appetite common symptom profiles in the general population as well? Depressive symptoms may also vary in their impact on individuals' psychosocial functioning, and have a different impact on different life domains (e.g. work and interpersonal relationships; Fried et al., 2016; Fried & Nesse, 2014). If we can better understand the type of symptoms athletes may be dealing with, we can also begin to map how these symptoms impact on athletes overall functioning and whether some symptoms, or combination of symptoms, predict worse mental health outcomes than others. This information would be crucial for the development of prevention that could address these issues before they escalate to more severe outcomes.

This does not, however, mean that sum-scores should not be applied or that they are not meaningful in research, but rather, that there may be several opportunities over and beyond sum-scores that symptom-based assessment could offer. As noted in this thesis, few studies have explored the opportunities that questionnaire-based assessment can offer, over and beyond the more commonly utilised sum-scores. As study two, three, and four showed, there is a wealth of information to be gleaned by analysing the specific symptoms of depression. The initial findings in study two suggested that female athletes showed higher

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prevalence on a range of different depressive symptoms than male athletes. When females and males were explored separately, younger female athletes (18-20 years) were found to be especially prone to exhibiting cognitive symptoms of depression in comparison to their older (≥ 24) counterparts. Younger male athletes (18-20) on the other hand were more likely to experience issues with sleep and appetite in comparison to older males (≥ 27).

Research in athletes has often noted that depression questionnaires are limited in their ability to provide a depression diagnosis, however, this may only be conceived as a limitation if the objective of the study is to assess the prevalence of clinical depression or MDD. As screening tools and depression questionnaires are not designed to provide this information – this limitation may not apply to the measure per se, but rather, reflects an overall limitation of the evidence base to-date within the field - a lack of empirical evidence of the rates of MDD. Hence, instead of perceiving the use of self-report measures as a limitation, future studies within the field should be clear about the purpose of the chosen assessment methodology and discuss limitations accordingly.

A limitation of screening tools is, however, the lack of evidence on their psychometric properties in athletes. The findings in this thesis suggests that it is possible that screening tools may potentially lead to a high rate of false positive cases. As discussed, study two underlined the importance of future studies to validate depression screening tools in the athlete populations. For example, it was found that when utilising the PHQ-9 cut-off ≥ 10 to identify clinically significant depressive symptoms, almost 40% of the identified cases did not exhibit depressed mood or lack of interest. In study three, approximately 30 % of athletes scoring above clinical cut-off did not present core symptoms, while in top-level athletes in study four, this rate was 50% at T1 and T3, and 100% at T2. As several athletes

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did not exhibit symptoms that are defined as the defining features of depression, the study findings raise an important question about the interpretation of sum-scores in athletes. The symptom profiles suggested that a large proportion of clinically significant cases experienced symptoms that were related to physiological/neurovegetative symptoms (sleep, fatigue, appetite, concentration). It is, however, important to underline that in study two 90% of athletes with clinically significant symptoms reported having experienced at least three different depressive symptoms most of the days in the past two weeks. Hence, although some athletes in this group did not experience the core symptoms of depression, they may have nevertheless experienced significant distress. As further shown in study three and study four, similar symptom patterns were observed, despite of the different types of athlete samples included in the studies (Icelandic and UK athletes, athletes from different sports and competition levels). This gives strong support for the importance of the more specific depressive symptoms including issues with sleep and fatigue. Some interesting patterns emerged in study four – sleep and fatigue seemed to cluster together, with prevalence rates varying in similar fashion across the three time points. In a similar vein, appetite, worthlessness/guilt and issues with concentration were all showing highly similar linear increase from T1 to T3.

In sum, in this thesis, issues with sleep, fatigue and appetite were highly prevalent in athletes, independent of the type of athlete sample explored. With these considerations in mind, future studies are encouraged to explore individual symptoms in addition to sum-scores further and explore symptoms concerning athletes' overall psychosocial functioning. Also, as will be discussed in the applied implications section – it is important that specific

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symptoms are considered in the applied settings to make more valid interpretations of the issues athletes may be dealing with.

Understanding individual differences in depressive symptoms

In the Response Styles Theory (Nolen-Hoeksema, 1991) and its subsequent revisions (Nolen-Hoeksema et al., 2008), depressive rumination is defined as a relatively stable cognitive vulnerability factor, which entails cognitive processes that emerge in response to sad or depressed mood. As proposed by Nolen-Hoeksema (1991), in individuals with a high tendency to ruminate, negative mood has a robust attentional valence which triggers thought processes about the negative mood, and the implications it may have for the individual. This habitual responding to one's negative mood or distress then further escalates negative mood and hampers constructive problem solving to alleviate this mood – potentially leading to more severe distress (Nolen-Hoeksema, 1991; Ólafsson et al., 2020; Watkins & Nolen-Hoeksema, 2014). Several empirical studies have provided evidence on the potential importance of depressive rumination, indicating that it has a central role in the onset (Just & Alloy, 1997; Nolen-Hoeksema, 2000), maintenance (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 1997; Spasojević & Alloy, 2001), and recurrence of depression and depression symptomology (Michalak et al., 2011). Treynor et al. (2003) found identified two depressive rumination factors, brooding and reflective rumination. Brooding rumination represents habitual responses to negative mood, which primes further negative affect before more adaptive goal-oriented responses can be generated (Nolen-Hoeksema, 1991; Ólafsson et al., 2020; Watkins & Nolen-Hoeksema, 2014), while reflective rumination represents a more goal-oriented, and potentially more

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adaptive process. Previous findings in non-athletes suggested that brooding, but not reflective rumination predicts depression over time (Treynor et al., 2003). Although rumination has been previously highlighted as an important vulnerability factor in the athlete mental health literature (Uphill & Dray, 2009), and often appears in texts when research findings are discussed - rumination itself has rarely been tested empirically in athletes (Kröhler & Berti, 2019).

In study three depressive symptoms were explored cross-sectionally from the perspective of the response styles theory. As identified in the background and in the literature review of this thesis (study 1), few of the prior depression-related studies in athletes have applied theory-driven assumptions to empirically test potential underlying mechanisms that could explain why some athletes are more likely to experience depression or depressive symptoms. With a more theory-driven approach, research can more systematically test, confirm, and/or reject specific assumptions about potential determinants of individual differences in depression. This could also advance current knowledge, over and beyond more general and demographic risk factors such as age or type of sport on depressive symptoms in athletes (Nixdorf et al., 2020). In study three, the results gave preliminary support for the validity of the response styles theory in athletes. The study explored the respective influence of brooding and reflective rumination on athletes' likelihood of experiencing clinically relevant depressive symptoms. Brooding rumination was found to significantly increase the odds of experiencing clinically relevant symptoms of depression, independent of athletes' reflection profile – while high reflective rumination was related to clinically significant symptoms only in conjunction with high brooding rumination. Considering the findings from study three and previous studies in the field

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which have shown that depressive rumination may have detrimental effects on athletic performance (Bennett et al., 2016) – the response styles framework may be highly relevant for further empirical work within the field of sport psychology. While this study provided preliminary evidence, one major gap identified in study one was the general lack of longitudinal investigations into depressive symptoms in athletes. This gap in the literature was addressed in study four.

Understanding the Vulnerability-Stress Interaction in Athletes

In the final “grand slam” of this four-study thesis, the response styles theory was further tested prospectively with an elite athlete sample. The study found further support for the utility of exploring depressive symptoms through the lens of the response styles theory. Similar to study three, study four highlighted the importance of brooding rumination as a prospective predictor of increased depressive symptom scores, while reflective rumination did not significantly predict these symptoms. In addition to exploring the relative contribution of reflective and brooding rumination on depressive symptoms over time, study four also explicitly tested the interaction between brooding and perceived stress on depressive symptoms over time. The findings provided support for the response styles theory in athletes, showing that brooding rumination measured at the beginning of the study significantly influenced the effects of stress on depressive symptoms. That is, athletes with higher brooding scores were more likely than athletes with low brooding scores to experience a higher increase in depressive symptoms when perceived stress was high. These findings add significantly to current knowledge in the field and provides empirical evidence that athletes who develop a tendency to brood are in a significant risk for

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exhibiting increased depressive symptoms when faced with stressful-life situations. Considering that athletes may often be challenged by a range of generic and sport-specific stressors, having a brooding tendency may place vulnerable athletes at a specifically high risk for depressive experiences. Based on the findings, future studies are encouraged to explore brooding rumination as a vulnerability factor for mental health issues in athletes and to explore potential determinants in the development of a ruminative response style in this population. As already partly voiced by Uphill and Dray (2009), one interesting avenue for future research in athletes would be to collectively examine cognitive vulnerability factors (e.g., negative attributions, dysfunctional attitudes, and brooding rumination) in relation to various mental health issues in athletes. Furthermore, how these vulnerabilities may interact with each other, and other concepts that may be relevant in the context of sports, such as mental toughness or flow/clutch states, would allow for improved understanding of the interaction between depression (or mental health) and athletic performance.

Applied Implications

Assessment of Depressive Symptomology

Service provision for athletes can vary largely across different sport settings (Kroshus, 2016; Moesch et al., 2018). In many countries, there are currently no systematic protocols in place for the assessment or treatment of mental health issues in athletes (Moesch et al., 2018). However, as the findings in this thesis suggest, more systematic

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approaches to providing mental health support among athlete populations may be warranted.

While systematic screening of depressive symptoms has been highlighted as important for identifying and supporting at-risk athletes (Donohue et al., 2019; Wolanin et al., 2016), “routine” screening has also been questioned. Notably, the potential for a high number of false-positive cases identified by screening tools could lead to adverse consequences, such as over-diagnosis of depression, and increased risk of labelling and stigma among individuals screened with elevated symptom scores (He et al., 2020; Joffres et al., 2013; Mojtabai, 2017). This suggestion may be especially relevant in athletes considering that screening tools have not yet been adequately validated in this population (Moesch et al., 2018). As shown in this thesis (study 2), while 90% of athletes with clinically significant sum-scores exhibited at least three different depressive symptoms, approximately 40% of athletes with clinically significant scores ($\text{PHQ-9} \geq 10$) and 50% of athletes with moderate symptom severity (clinically significant score 10-14), did not exhibit the core symptoms of depression (depressed mood and lack of interest).

If systematic screening is conducted in settings where there is already a suitable support infrastructure in place, it is important to determine which screening tool(s) and cut-off score(s) are utilised to identify athletes for a follow-up (Trojian, 2016). Considering that screening tools are designed to overestimate “true” clinical cases to minimise potential false-negative cases - rather than merely “red -flagging” athletes with clinically significant depressive symptom scores - exploring the specific symptomology could potentially improve the specificity of the screening results. For example, analysing scores specifically for symptoms such as depressed mood and/or lack of interest, insomnia, or suicidal

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thoughts may be important when considering further follow-up (Joffres et al., 2013).

Furthermore, it is important to determine how initial screening results are communicated to athletes, and that athletes are included in the process when determining potential mental health referrals (Donohue et al., 2018; Joffres et al., 2013; Trojian, 2016). Considering the findings in study 2, discussing specific symptoms and related issues that are especially relevant for athletes could potentially improve this decision-making process.

As shown in a study by Kroshus (2016), on average, there was one full-time physician for each NCAA Division I sports medicine department, and 376.4 student-athletes per physician. Applying the 23.7% prevalence rate reported in college athletes by Wolanin et al. (2016) and the average number of students per physician reported by Kroshus (2016), at any given time there would be approximately 89 NCAA Division I collegiate athletes per physician screened with clinically significant depressive symptoms. This finding underlines the importance of conducting an evidence-based assessment of the target population, and the resources required to assure that appropriate follow-up assessment and mental health support can be provided to athletes following the screening process. It must, however, be noted that the aim of this thesis was not to recommend for or against screening in athletes. Nevertheless, the findings in this thesis highlight the potential utility of exploring individual depressive symptoms in settings where screening protocols are being planned or already in place.

In study two, 17% (n=138) of athletes with non-clinically significant depressive symptom sum-scores, reported experiencing 1-2 depressive symptoms most of the days in the past two weeks. It is, therefore, important for practitioners working with athletes to be mindful of the possibility that, although an athlete does not present with clinically

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significant depressive symptom sum-scores, they may nevertheless experience significant distress and impairment in specific areas of functioning (e.g. issues with sleep/appetite, feelings of guilt). Therefore, independent of the sum-scores, it may be beneficial to discuss with athletes the individual symptoms on which they may exhibit elevated scores. This discussing of symptoms could also open new doors to identifying other potential mental health issues (Mummery, 2005; Trojjan, 2016). For example, as hinted by study two and four in this thesis, there is considerable overlap between symptoms of depression and other conditions relevant in the athlete population, such as overtraining syndrome (OTS; Kreher, 2016), burnout (Nixdorf et al., 2020), and eating disorders (Kristjánsdóttir et al., 2019). Therefore, a detailed analysis of the specific symptomology may provide the practitioner with additional road signs when conceptualising potential issues that may need further assessment.

One of the interesting, and perhaps surprising, findings in study two was that there were significant differences in the mean sum-scores and the prevalence of specific symptoms between the three team sports included in the study. This suggests that even across sports that could be considered similar in terms of the nature of the competition (e.g. team-based with competition outcome evaluated objectively, i.e. scoring points/goals) – there may be important contextual differences influencing athletes' mental health (Rice et al., 2016). Therefore, practitioners working in team-based settings could benefit from exploring specific symptoms to gain clues to the potential contextual factors that could undermine athletes' well-being and performance. For example, if sleep issues seem to be highly prevalent in the team or within the organisation, the practitioner could map potential

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risk factors (e.g. training times, logistic issues concerning travelling etc.), and consequently plan targeted interventions to address these issues.

Treatment and Prevention

Randomised controlled trials in non-athlete samples highlight the importance of targeting ruminative responses, as decreases in rumination have shown to lead to decreases in depressive symptoms (Manicavasagar et al., 2012). Considering that brooding significantly predicted clinically significant depressive symptoms (study 3) and showed to predict increases depressive symptoms over time (study 4), practitioners working with athletes could benefit from a detailed assessment of athletes' brooding tendencies and conceptualising the potential functions of rumination in the athletes' presenting issues. That is, systematically mapping athletes' brooding tendencies (e.g., antecedents-behaviour-consequences) and how it may link to athletes' issues could be explored together with the athlete. This may allow the practitioner and the athlete to target ruminative tendencies and potential barriers to optimal outcomes. Targeting brooding may also be effective, not only in treating levels of depression but also co-morbid issues such as anxiety and eating disorders as well as overall psychosocial functioning (Watkins et al., 2007). As found in the current study, athletes across studies 2-4 exhibited especially high prevalence rates of sleep and fatigue. Based on notions made by Watkins et al. (2007) targeting brooding tendencies may provide an effective strategy to address these issues. Changes in rumination may also underlie the beneficial effects observed in mindfulness-based interventions (Baer, 2009). Hence, mindfulness-based approaches such as the Mindfulness Acceptance Commitment approach to performance enhancement (MAC; Gardner & Moore, 2007) may be promising

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for attenuating brooding tendencies, which could lead not only to decreases in depressive symptoms, but also increases in performance related outcomes in athletes. As several different potential approaches to targeting ruminative tendencies exists (Fisher & Wells, 2009; Segal & Teasdale, 2018; Watkins, 2016), and that rumination may be a relevant mechanism, not only in terms of clinical disorders, but also in terms of sport-specific functioning of athletes (Bennett et al., 2016; Uphill & Dray, 2009), introducing and applying rumination-focused approaches in the context of sports could provide exciting opportunities for future prevention, treatment, and research efforts in athletes.

Sport Psychology Application

The sport psychology practitioner plays a pivotal role in linking academic research and applied practises. Based on the findings in this thesis, the sport psychology practitioner could contribute to improved applied practices by raising awareness of the potential risk factors linked with the development of brooding tendencies. For example, raising awareness among parents, athletes, and coaches about the developmental underpinnings of ruminative response style, and its relation to mental health issues and performance, may allow sport organizations to more carefully implement guidelines for optimizing coaching and parenting practices in and out of the competitive sport setting. Furthermore, while raising awareness of the implications of a ruminative response style on mental health and performance is important, it is also essential to provide athletes and stakeholders with concrete solutions to promoting more adaptive ways of responding to distress. Considering that ruminative tendencies are not explicit observable behaviours - psychologists working in sport, especially in youth sport, could assess ruminative tendencies via questionnaires to

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identify in-risk athletes, and guide them on how to develop more adaptive behaviours in response to distress. Furthermore, with an understanding of the determinants of a ruminative response style, the sport psychology practitioner could more systematically observe coach-athlete relationships to identify potential risk behaviours (especially in youth sports) – and subsequently provide potential solutions to improving these relationships.

As discussed by Nolen-Hoeksema et al. (2008), there are at least three mechanisms by which rumination may impact on depressive experiences. Perhaps the most prominent idea is that engaging in rumination in response to a negative mood increases the individuals' attention on the mood which consequently further escalates it. The sport psychology practitioner could play an important role in educating not only athletes, but also stakeholders (e.g., parents and coaches) of the negative psychological consequences linked with ruminative processes, and of the type of behaviours that may be most adaptive to breaking the cycle. Hence, it is not only important to make athletes aware of the negative consequences of rumination in response to negative mood, but also, it is essential that the sport psychology practitioner guides the development of an athletic environment in which athletes are consistently prompted to deal with negative thoughts and emotions in an adaptive manner. In some athletic environments, this would mean that a fundamental shift in perspective must first take place. That is, rather than seeing negative thoughts and emotions as a weakness or as something that is “forbidden”, it is important that coaches explicitly accept negative thoughts and emotions as a natural part of the performance environment, subsequently allowing for the creation of an environment that is designed to promote adaptive behaviours to dealing with, rather than avoiding, these issues.

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An important piece of the puzzle is to understand that athletes do not exist in a vacuum. The sport psychology practitioner could therefore have a central role in disseminating knowledge concerning the potential negative implications of coaches' (as well as parents') ruminative tendencies in response to negative mood. For example, it is likely, especially in high-performance sports where the athlete and the coach work closely together (e.g., individual sports), that coaches' mood and subsequent behaviours will impact on how athletes perceive the athletic environment in which they operate - consequently, influencing the athletes' well-being and athletic performance (Stebbing et al., 2016). Hence, if a coach (or parent) tends to respond to distress with rumination, they may also become increasingly self-aware, passive, and indifferent, potentially leading to harmful leadership behaviours and inadequate support for the athletes (Stebbing et al., 2016).

Another mechanism by which rumination may exert negative effects on the individual is by attenuating problem solving and concrete behaviours that lead to beneficial outcomes for the individual (Nolen-Hoeksema et al., 2008). Problem solving may be especially hampered among individuals who have developed brooding qualities, as brooding may represent habitual responding to negative mood. This suggests that when the individual experiences distress, brooding responses may be initiated before more adaptive goal-oriented responses can be applied (Ólafsson et al., 2020). It has been suggested that while "high-ruminators" can generate rational ideas about adaptive coping strategies, when experiencing distress, they may be less likely to engage in the behaviours needed to accomplish these strategies (Nolen-Hoeksema et al., 2008). Therefore, although athletes (and coaches or parents) may be well-aware of the types of solutions that are most adaptive

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– the challenge is how to promote engagement in these behaviours when individuals are distressed. The sport psychology practitioner could play an important part in developing “hands-on” approaches to promoting adaptive behavioural repertoires and environmental cues that promote adaptive behaviours in response to negative mood in training and competition. Furthermore, these behaviours should be promoted systematically and consistently with the goal of ingraining these practices as a normative part of the performance culture.

Considering that habitual brooding may be the result of conditioned learning, behavioural approaches could be effective in extinguishing learned maladaptive responses, while replacing them with new, more adaptive behaviours. For example, utilising the “if-then” framework could prove useful when working with individual athletes or when designing interventions targeting the overall training environment. In the “if-then” framework, the aim is to first identify situations that usually trigger ruminative thought processes (“if”) and second, to identify, plan, and practice more beneficial responses that are incompatible with the maladaptive behaviour (“then”) (Watkins, 2016). This approach could be further developed for, and tested in, athletes in future intervention research, and could be introduced for coaches during development courses and seminars through psychoeducation and practical exercises.

All-in-all, the role of the sport psychology practitioner is vital in disseminating awareness of rumination, and its impact on well-being and performance. Furthermore, the sport psychology practitioner could move beyond merely educating on the importance of adaptive coping strategies, by providing practical solutions adapted to the specific sport context, and hence, promoting adaptive response to negative mood in training and

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competition. With the support of the sport psychology practitioner, more systematic and consistent approaches to increasing the functioning of individuals when experiencing distress could be ingrained into daily practices – potentially leading to more healthy and successful performance of the individuals' within and outside the context of sports.

Limitations

Some limitations to the overall findings of this thesis should be mentioned. As discussed in the introduction of this thesis, when promoting optimal mental health in athletes, an understanding of both the mental health and mental illness continuums is important. As this PhD dissertation was specifically focused on depressive symptoms (i.e., the mental illness continuum) this dissertation does not offer information concerning mental health or the overall functioning of athletes who experienced clinically significant depressive symptoms. Nevertheless, as rationalised in the introduction, sport psychology research has traditionally been focused on the health promoting factors of, and within, sport (and exercise), with research on psychological ill-health only recently beginning to attract attention within the field. While being limited in terms of exploring other mental health outcomes such as general psychosocial well-being and functioning, this thesis adds important knowledge concerning the potential underlying mechanism that may increase susceptibility to depressive symptoms – providing important knowledge concerning the potential barriers to promoting optimal mental health in athletes.

The different samples explored in this thesis could also pose some limitations to the generalizability and interpretation of findings. For example, samples varied in terms of size, the type of athletes included, and cultural context. Hence, findings from the different

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studies, especially in terms of differences in depressive symptoms, should be interpreted with this limitation in mind. Future research may want to explore differences across different athletic contexts (different sports and cultures) by utilising more stringent sampling methodology. On the other hand, the heterogeneous samples included in this thesis may have also provided some strengths in terms of the interpretation of observed similarities across the samples. For example, it is interesting to note that fatigue and sleep problems were consistently most prevalent symptoms across the different athlete samples, suggesting that these symptoms may be especially relevant in athletes in general.

There are also some limitations concerning the statistical and analytic strategies employed in this thesis. With a binary logistic approach in study two and three, the more subtle differences across predictors were not explored. That is, as the different levels of the predictor variables were compared only against the reference group (e.g., age¹ vs. reference, age² vs. reference etc.) – differences between different levels were not explicitly explored (e.g., age¹ vs. age²). Furthermore, in study three, athletes were categorised into rumination profiles by utilising a median split approach. This method is limited in the manner that differences between individuals close to either side of the cut-off points may not be significantly different – and grouping those individuals into different categories may therefore not reflect true differences in brooding or reflection tendencies. However, in study four brooding and reflection were tested as continuous variables in the multilevel models, supporting the expected importance of brooding, but not reflective, rumination as a prospective risk factor for elevated depressive symptoms.

There are also some theoretical considerations in relation to study four that should be addressed in future research. The main limitation concerns the temporal relations

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between perceived stress and depressive symptoms. For example, as both variables were assessed at the same time it was not possible to disentangle whether increases in the perception of stress preceded increases in depressive symptoms or vice versa. However, as the assessment of perceived stress spans the past month, and depressive symptoms the past two-weeks, there is some (weak) indication that stress may have preceded depressive symptoms. Future research could benefit from experimental research or by utilising ecological momentary assessment to further test the temporal relations between rumination, stress, mood, and mental health outcomes (e.g., depressive symptoms, well-being, and overall or sport-specific functioning). Despite the limitations concerning the temporal relations between depressive symptoms and perceived stress, the findings showed that brooding rumination measured at the start of the study period consistently predicted elevated depressive symptoms over time. The response styles theory may, hence, provide exciting opportunities for further research within the athlete populations.

Cognitive Vulnerability in the Context of Sports: Implications for Future Research

As described in a study by Gervis and Dunn (2004), an athlete described how coach behaviours had a lasting influence on their psychological development:

I gave up because I had no confidence, because she constantly told me that I was crap and worthless all the time. I believed this and it carried on into general life and I am now scared of rejection, failure, because of the things she did. (Gervis & Dunn, 2004, p.221)

To date, most depression-related research in athletes have focused on prevalence rates and correlates of depressive symptoms in athletes at one point in time – often at the time

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athletes have already reached elite-level status (Golding et al., 2020). However, as vividly suggested by the opening quote, vulnerability to depression may become established already in early adolescence (Abela et al., 2012; Mezulis et al., 2006, 2010). Hence, it is important to understand how socialization through sports may contribute to the development of individual differences in vulnerability to depressive symptoms in athletes. By exploring the longitudinal relationships between depressive rumination, stress, and depressive symptoms - the current thesis provided a novel perspective within sport psychology literature on why some athletes may be more likely to experience depression. However, while the current thesis showed that stress had a more pronounced effect on depressive symptoms in athletes with high brooding tendency, it was also solely focused on adult athletes. Considering that depressive rumination may develop in early adolescence, it is important to glance “back in time” to better outline future directions. In this concluding section, I will therefore discuss athletes as a unique population in terms of issues relating to the developmental aspects of sport participation and the potential links to the development of depressive rumination in this population. By doing so, I hope to further contextualize the implications of the current thesis in relation to future research in the field.

In addition to the generic risk and protective factors that may be embedded in athletes’ personal lives outside the context of sports (family, peers, school etc.), athletes are subject to important influences emanating from socialisation in and through sports. Participation in sports have been linked to lower levels of depression and anxiety symptoms in adolescence (Panza et al., 2020), lower risk for risky behaviours such as alcohol consumption (Halldorsson et al., 2014), and overall more beneficial psychological outcomes when compared to youth not involved in organized sports (Eime et al., 2013).

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While these studies show that there is overall robust evidence for the beneficial impact of sport participation during childhood and adolescence – as shown in this thesis athletes from different cultural context, different sports, and different competition levels exhibit depressive symptoms with overall clinically significant symptom prevalence ranging from 5-20%. The findings in this thesis also showed that cognitive vulnerability in the form of depressive rumination significantly increase the risk for clinically significant depressive symptoms in these athletes (study 3). The question that one may therefore ask is - what contributes to the development of these differences in vulnerability that seems to endure into adulthood?

One hypothesis that may be plausible is that the developmental outcomes in athletes vary depending on the specific sport context in which socialisation through sports takes place. For example, as reviewed by Côté & Vierimaa (2014), early diversification and early specialisation in sports (sports engagement in several sports and engagement in one specific sport, respectively) have shown to relate to different developmental outcomes, with more negative outcomes linked with early specialisation (less enjoyment, increased likelihood of burnout and early dropout) than with early diversification. As further reviewed by Côté & Vierimaa (2014), more positive outcomes in early diversification compared to early specialisation has been shown in the form of the development of a broader physical skill set increasing the likelihood of continued recreational sports involvement later in life, decreased likelihood of repeat injuries, development of healthy identity, and social skills. It is also underlined that specialisation is most beneficial in mid-adolescence or at about the age of 16.

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In some individual sports such as gymnastics and figure skating in which specialisation often occurs earlier – adverse outcomes such as injuries and lack of enjoyment are more prevalent (Côté & Vierimaa, 2014). It is interesting to note that recent findings suggest that athletes in these sports have also shown to exhibit significantly higher prevalence of clinical depression than athletes from other sports (Schaal et al., 2011). Others have also identified that individual sport athletes may be in general more likely than team sport athletes to report elevated depressive symptoms (Beable et al., 2017; Nixdorf et al., 2013). In this thesis (study 3) no difference between team sport and individual sport athletes was, however, observed in relation to depressive symptoms – which could be due to the type of athletes that were (or not) included in the sample in study three. Although current evidence does not allow for conclusive interpretations to be made, some authors have suggested that the nature of competition (evaluative components related to the performance of the individual rather than a team) make individual sport athletes more likely to develop personal qualities that may contribute to elevated depressive symptoms in response to athletic failure (Nixdorf et al., 2016). This may be especially true if specialisation takes place at a young age. For example, rumination involves a repetitive and evaluative approach to thinking about oneself in relation to others and the discrepancy between current and desired state (Watkins, 2016). Considering that athletes are likely to set high standards for achievement, often in comparison to others, athletes could be especially prone to experiencing chronic goal-discrepancies (never satisfied with performance, always something to improve). If these situations are systematically imposed on young athletes who may not have yet developed adaptive coping skills, there is a risk that rumination may develop into a default mode of coping in response to goal-

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discrepancies/negative mood. According to the recent theoretical extension to the response styles theory (Watkins & Nolen-Hoeksema, 2014), however, brooding rumination would only develop into a habitual tendency if the athlete would consistently engage in abstract and negative cognitive processing of negative mood. The importance of the context in which athletes gain life experiences may therefore act as an important determinant on how young athletes learn to respond to potential negative experiences (e.g., goal-discrepancies).

Considering that the pursuit of optimal performance is central to competitive sports, the performance of the athlete may not only influence the athlete themselves but also others that are invested in the athlete's performance (e.g. coaches, parents) (Gervis & Dunn, 2004). It has been noted that in early specializing sport contexts where mastering of complex technical skills is more stringently emphasized, adult-style practices and high training volumes may be more common - potentially leading to an environment where young athletes are exposed to performance pressures from an early age (Myer et al., 2015). Consequently, in some highly competitive youth sport contexts athletes may also be subjected to harmful behaviours from authority figures. For example, athletes may be subjected to manipulation or verbal abuse, excessive personal control or dismissal of individuality and autonomy (Bartholomew et al., 2009). In these highly competitive sports environments, harmful behaviours may often be masked under the performance narrative and may become normalised as part of the "pathway-to-excellence" and "win-at-all-cost" discourse (Jacobs et al., 2017; Mountjoy, 2020). For example, in an extensive survey conducted at the Youth Olympic Games in Buenos Aires 2018 among athletes 15-18 years old, findings showed that while the majority of youth athletes identified sexual abuse and harassment, inappropriate training and training environments, doping and cyberbullying as

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abuse or harassment, less than half of the athletes identified training injured, sick or exhausted as harassment or abuse. Furthermore, 47% of athletes reported being surprised by the fact that these latter behaviours (training injured, sick or exhausted) constituted of different forms of harassment and abuse (Mountjoy et al., 2020). When sports environments consistently discourage expression of thoughts and opinions (e.g., perceived as a weakness by authority figures), while also exposing the young athlete to critical and punishing adult behaviours - athletes may be more likely to engage in internal dialogues to deal with the consequent negative mood (Watkins, 2016), and ruminative habits may develop as a coping mechanism (Nolen-Hoeksema, 1991; Shaw et al., 2019).

It is also possibly, that the development of depressive rumination in athletes emanate from context outside sports (e.g., home/parents). In this case, athletes may enter organized sports with an already established vulnerability with the sports environment either exerting protective or further harmful effects on the individual. As discussed by Doherty et al. (2016) it is possible that sport becomes a vehicle by which cognitive vulnerabilities are carried dormant throughout adolescent years until they interact with more severe stressors as the athletes climb the ladder of achievement. Hence, it is possible that despite an underlying vulnerability, positive youth sport environments may initially protect athletes from mental health issues, but as pressure and stress becomes more prominent (i.e., transition into elite-sports) the underlying vulnerability may be activated leading to increased distress. For example, as noted in a research by Gervis and Dunn (2004), the interviewed athletes observed a shift in coaching behaviours and became more negative once athletes were identified as elite performers. If this shift in the environmental stressors takes place in childhood (e.g., early specialisation) there may be in increased risk

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that developmental outcomes may be compromised. In this thesis (study 4) it was found that junior national team athletes had higher brooding scores than A-national team athletes. Whether this means that athletes who tend to brood drop-out, and low-brooders are more likely to advance to A-level – or that differences were due to A-level athletes' experience at the elite level, remains unanswered. Nevertheless, this finding underlines that coaches should be well-informed concerning the negative implications of brooding rumination and adapt their coaching behaviours to match the psychological needs of the athlete(s), especially when coaching young athletes transitioning to the elite-level. On a more positive note, vulnerability to depression in athletes may also be understood as a double-edged sword. While athletes may endow characteristics (e.g. rumination, negative attributional style, maladaptive perfectionism) that may push them to the verge of depression or other mental health issues, other characteristics (e.g. goal-setting, commitment, perseverance) acquired through sports may help them overcome these issues (Doherty et al., 2016).

In sum, considering that engagement in sports overlaps with the crucial developmental years throughout childhood and adolescence when vulnerabilities to depression or other mental health issues may become established - the elements ingrained in different sport contexts may significantly influence the development of athletes' underlying cognitive makeup. As the current thesis showed, brooding may be an important vulnerability to depression in adulthood, and hence, future research is needed to understand the developmental trajectories of cognitive vulnerability in athletes. Although sports are generally considered as a protective factor, not all sports environments provide the same protective benefits. Unfortunately, the harmful influences of sport may sometimes be so deeply ingrained in the “culture of performance excellence” that they may be difficult to

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change (Jacobs et al., 2017; Mountjoy, 2020). When these cultural practices are also present in the grassroots levels of sport, the long-term adverse mental health outcomes may be detrimental. Important insights into the influence of the sport context on the development of ruminative tendencies could be gained by exploring different youth sports environments (e.g. outcome-oriented, early initiation or specialisation) and/or youth coaching environments (e.g. criticism, excess control). If some contexts are more likely to facilitate or contribute to an increased tendency to ruminate, early prevention strategies could be designed to attenuate these trends. This work should be prioritised in the field - the fact is that it may be too little-too late to refer an athlete to counselling if the environments in which they operate are consistently toxic. As noted by Purcell et al. (2019):

Any mental health framework that ignores wider ecological factors runs the risk of focusing exclusively on, and potentially pathologising the individual athlete, when other factors may be more influential in contributing to, or perpetuating, poor mental health (p.3).

As we gain more empirical evidence on the rates of mental health issues in athletes, the underlying mechanisms, and environmental forces that contribute to suffering in the athlete population, the inevitable voice of the dilemma will come echoing; how do we translate this empirical knowledge into practice, over and beyond consensus statements and policies? This dilemma may be especially relevant in environments where change is most desperately needed - how do we change deeply rooted toxic practices, and ultimately, how do we kill the sacred veneer?

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Appendices

Appendix 1

Summary of all included studies sorted by depression measure (*cs=cross-sectional , lt=longitudinal, iv= intervention)

Authors (Year)	Measure	Prevalence reported	Cut-off	Design *	Status	Sport(s)	Level	Athlete sample size	Age	Gender	Variables measured in relation to depression
Polat et al. (2015)	BDSA	No	N/A	CS	Current athletes	Not specified	Amateur	N=100	N/A	Male n=76, female n=24	Beck Depression Inventory
Aslan et al. (1998)	BDI	No	N/A	CS	Current athletes	Soccer	Amateur	N=145	N/A	N/A	Self-esteem, anxiety, injury
Barmi (2011)	BDI	Yes	1-10, 11-16, 17-20, 21-30, 31-40, 41-63	CS	Current athletes	Not specified	Universit y	N=80	N/A	Male	Team vs. individual sport vs. non-athletes
Feyzioğlu et al. (2019)	BDI	No	N/A	IV	Current athletes	Not specified	Elite	N=15	N/A	N/A	Time (pre- intervention and post- intervention), elite athletes vs. non athletes
Haji Rasouli & Rohani (2005)	BDI	No	N/A	LT	Current athletes	Not specified	Olympic	N=95	N/A	N/A	Time (pre-post 3- week residency in Olympic conditioning campus)

Haslacher et al. (2015)	BDI	Yes	> 10	CS	Current athletes	Multiple; Marathon runners and endurance cyclist	Amateur	N=56	M = 65.93 (SD = 4.77)	Male n=50, Female n=5	Athletes vs. non-athletes, genotype
Klock & DeSouza (1995)	BDI	No	N/A	CS	Current athletes	Running	Amateur	N=16	M=27.5 (SD=1.0) and M=32.1 (SD=1.3)	Female	Amenorrheic runners vs. eumenorrheic runners vs. eumenorrheic sedentary women
Leddy & Lambert (1994)	BDI	Yes	0-9, 10-15, 16-19, 20-29 30-63	LT	Current athletes	Multiple	University	N=343	M=20.42 (SD=2.06, range 17 to 26)	Male	Time (pretest, postinjury, and follow-up), injury
Levit et al. (2018)	BDI	Yes	> 17	CS	Current athletes	Multiple	Multiple	N=100	M = 28.33 (SD = 8.38, range 18 to 62)	Sex specific and total sample do not add-up	Gender, level of sport, individual vs. team, exercise addiction
Manuel et al. (2002)	BDI	Yes	> 15	LT	Current athletes	Multiple	Amateur	Baseline N=48	Range 15 to 18 years	female 58%	Gender, injury onset (time), injury severity, stress, athletic identity, social support
Nudelman et al. (1988)	BDI	No	N/A	CS	Current athletes	Running	Amateur	N=20	M=25.3 (SD=2.6)	Male	High intensity male runners vs. male controls vs. female bulimics

Oztekin et al. (2008)	BDI	No	N/A	LT	Current athletes	Soccer	Multiple	N=30	Amateur M=26.7, pro M=25.5	Male	Time (24 h before ACL surgery, one week after surgery, and three weeks after surgery), professional vs. amateur, pain
Prussin & Harvey (1991)	BDI	No	N/A	CS	Current athletes	Running	Amateur	N=179	Bulimic M=32.79 (SD=1.69), non-bulimic M=31.74 (SD=7.56)	Female	Bulimic vs. non-bulimic female runners
Rodrigues et al. (2017)	BDI	Yes	0-9, 10-15, 16-19, 20-29 30-63	LT	Current athletes	Track	Olympic (para)	N=19	28 (SD=6)	Male n=15, female n=4	Time (beginning and end of season, and pre-competition)
St-Hilaire & Marcotte (2005)	BDI	No	N/A	CS	Current athletes	Not specified	Elementary/high school/secondary school	N=71	M = 15.17 (range 14 to 17)	Female	Restricting vs. non-restricting sports vs. a control group
Unver et al. (2015)	BDI	No	N/A	CS	Current athletes	Wrestling	Multiple	N=79	Under or over 20	Female n=34, male n=79 (not specified for athletes)	Students, national team and non-national team wrestlers, gender, age

Vancini et al. (2019)	BDI	Yes	N/A	CS	Current athletes	Multiple; Wheelchair basketball and rugby	Amateur	N=23	Athlete M=36.0 (SD=10.0)	Male n=26, female n=13	Athletes vs. non-athletes
Vigário et al. (2019)	BDI	No	N/A	CS	Current athletes	Multiple	Amateur	N=44	26.8 (SD=6.0)	male 72.7%	Competitive level
Willer et al. (2018)	BDI	Yes	> 13	CS	Former athletes	Multiple; Ice hockey/ American football/ athlete controls	Multiple	N=42	Contact sport M=56.7, non-contact sport M= 55.4	Male	Retired contact sport vs. noncontact sport athletes
Yavuz & Oktem (2012)	BDI	No	N/A	CS	Current athletes	Multiple; Swimming and track and field	Elite	N=100	M=20.50 (SD=2.93, range 17 to 25)	Male n=25, female n=25	Gender, type of sport, reaction times
Konietzny et al. (2019)	BDI-FS	Yes	≥ 4	CS	Current athletes	Multiple	Multiple	N=159	M=28.63 (SD=9.69)	Male n=94, female n=65	Stress, pain related thought suppression, suicidal ideation, chronic daily stress, gender
Ramanathan et al. (2012)	BDI-FS	Yes	≥ 2	CS	Current athletes	Multiple	University	N=256	M= 18.2 (SD= .7, range 17 to 22)	Male n=184, female n=72	Initial bias, examiner affect rating

Riegler et al. (2019)	BDI-FS	Yes	≥ 4	LT	Current athletes	Multiple	University	N=113	M=18.52 years (SD=.93, range from 17 to 22 years)	Male n=91, female n=22	Age, IQ, sex, no. of previous concussions, history of learning disability, history of ADHD, ethnicity, sport, neuropsychological battery tests (processing speed composite, memory composite)
Riegler et al. (2019a)	BDI-FS	Yes	≥ 4	CS	Current athletes	Multiple	University	N=930	M=18.53 (SD=1.07, range 17 to 24)	Male n=695 (74.7%), female n=235 (25.3%)	Gender, post-concussion symptoms
Vargas et al. (2015)	BDI-FS	Yes	≥ 4	LT	Current athletes	Multiple	University	N=84	Concussed M=18.4 (SD=0.8) Control M=18.9 (SD=0.9)	Male concussed n=65, female concussed n=19	Gender, age, concussed athletes vs. non-athletes, IQ, post-concussion symptoms, age of sport initiation, years in sport, number of games missed due to concussion, number of previous concussions, average number of drinks per

											week, number of times used marijuana
Baker et al. (2018)	BDI-II	Yes	>13	CS	Former athletes	Multiple; Ice hockey/American football/athlete controls	Professional	N= 42	Contact M=56.7, non-contact M=55.4	Male	Contact sports vs. non-contact sport athletes
Bravata et al. (2003)	BDI-II	No	N/A	CS	Current athletes	Not specified	University	N=57	M= 20.0 (SD=20 mo., range 18 to 26)	Female n=39, male n=18	Gender, problematic eating patterns
Brett et al. (2019)	BDI-II	Yes	0–13 14–19 20–28 29–63	CS	Former athletes	American football	Professional	N=43	M=46.35 (SD=9.16)	Male	Sport related concussion history, somatic symptoms
Bunce (2014)	BDI-II	Yes	0–13 14–19 20–28 29–63	CS	Current athletes	Multiple	University	N=51	Range 18 to 24	female n = 30, male n = 21	Pre-injury to post-injury (retrospective time), removed from sport, ethnicity, gender, age, socioeconomic status, type of sport, years in sport
Chen et al. (2008)	BDI-II	Yes	0-9, 10-19, 20-29	CS	Current athletes	Multiple	Multiple	N=56	M _{range} = 20 - 30	Male	Concussed athletes vs. non concussed athletes, post-

											concussion symptoms, age, working memory, task related brain activation (fMRI), structural MRI
Covassin et al. (2019)	BDI-II	Yes	> 10	CS	Current athletes	Multiple	University	N=296	M=18.0 (SD=0.41)	male n = 125 (57.8%), female n = 171 (47.2%)	Seasonal Affective Disorder, gender
Covassin et al. (2012)	BDI-II	Yes	0-13, 14-19, 20-28, 28-63	CS	Current athletes	Not specified	High school and collegiate /University	N=1616	M _{range} = 15.7 - 19.9	Males n = 1104, females n = 512	Age, gender, high school vs. college, neurocognitive performance, concussion symptoms
Didehbani et al. (2013)	BDI-II	Yes	>10	CS	Former athletes	American football	Professional	N=30	M= 58.60 (SD = 10.33, range 41 to 77)	Male	Retired NFL athletes vs. matched non-athlete controls, number of lifetime concussions, age, education, IQ, years played
Donohue et al. (2015)	BDI-II	No	N/A	IV	Current athletes	Not specified	University	N=7	M= 20 (SD = 1.53)	Male n=4 (57%), female n=3	Time (pre, post, 1-month follow-up, 3-month follow-up)

Donohue et al. (2018)	BDI-II	No	N/A	RCT	Current athletes	Not specified	University	N=74	M=20.64 (SD=2.26), intervention M=20.55 (SD=1.77), control M=20.72 (SD=2.71)	Male n=38 (51.4%), female n=36 (48.6%)	TOPPS (treatment) and SAU (control) across time and Multiple Diagnosis, Single Diagnosis, No Diagnosis
Fewell et al. (2018)	BDI-II	No	N/A	CS	Current athletes	Not specified	Amateur	N=91	M=19.4 (SD=3.0)	Female n=80 (87.9%), male n=11 (12.1%)	Athlete vs. non athlete, Eating disorder symptoms
Hammond et al. (2013)	BDI-II	Yes	>13	CS	Current athletes	Swimming	Elite	N=50	M=20.5 (range 18.2 to 26.7)	male n=28, female n=22	Time (before and after competition), DSM-IV-TR, ranking, change in ranking, change in performance time, history of depression, gender
Kontos et al. (2012)	BDI-II	Yes	N/A	LT	Current athletes	Not specified	High school and collegiate /University	N=75	High school M=15.74 (SD=1.28), College M=	Male n=51, female n=24	Age, gender, post-concussion (time), high school vs. college, neurocognitive performance,

									19.68 (SD=1.33)		concussion symptoms
Lodis et al. (2012)	BDI-II	Yes	≥ 12	CS	Current athletes	Multiple	University	N= 98	M=19.83 (SD = 1.65)	Male n= 53, female n=45	Athletes vs. non-athletes, gender, Seasonal Affective Disorder
Moore et al. (2016)	BDI-II	No	N/A	CS	Current athletes	Multiple	University	N= 81	Concussed M=21.2 (SD=0.2) Non-concussed M=21.3 (SD=0.4)	Male	Athletes with history of concussion vs. control athletes, EEG alpha and beta asymmetry
Owen (2016)	BDI-II	No	N/A	CS	Current athletes	Multiple	University	N=108	M=21	Male n=51 (47.2%), female n=57 (52.8%)	Perceived social support, sport-related chronic pain, gender, race, level (year) of university education
Ruiter et al. (2019)	BDI-II	No	N/A	CS	Former athletes	American football	Professional	N=19	M= 57.6 (range 45 to 66)	Male	Retired athletes vs. non-athlete controls, electrophysiological responses
Strain et al. (2013)	BDI-II	Yes	>13	CS	Former athletes	American football	Professional	N=26	M= 57.8 (SD 11.3,	Male	Age, experience in the NFL, number of concussions,

									range 41 to 79)		white matter integrity
Thomson & Jaque (2016)	BDI-II	Yes	≥ 17	CS	Current athletes	Not specified	Multiple	N= 49	M=23.44 (SD=2.29)	Male n=28 (57.1%) female n=21 (42.9%)	Age, gender, dancers vs. singers vs. athletes, over-excitability
Uglesić et al. (2014)	BDI-II	Yes	≥ 12	CS	Current athletes	Not specified	University	N=664	M=19.2	Female n=466 (72.3%), male n=178 (27.7%)	Non-active in sports, recreational, active in sports, gender
Amato (1996)	BDI-SF	No	N/A	CS	Current athletes	Ice hockey	Elite	N=77	M=18.29 (range 16 to 20)	Male	Stress, personality, anxiety, coping strategies, social support, injury
Gibson et al. (2006)	BDI-SF	Yes	>4	CS	Current athletes	Multiple	Amateur	N=30	ATI athletes M= 40.4 (SD= 8.7), control athletes M=38.1 (SD= 12.8)	ATI Male n= 16 Female n= 4, control male n= 6, female n= 4	Athletes with acquired training intolerance (ATI) vs. athlete matched controls
Bäckmand et al. (2003)	-	No	N/A	LT	Former athletes	Multiple	Elite	N= 664	M= 64.6 (SD=9.2)	Male	Former athletes vs. matched controls, age, type of sport

Bäckmand et al. (2009)	BSI	Yes	N/A	LT	Former athletes	Multiple	Elite	N=504	M= 68.6 (range 52.0 to 100.0)	Male	Age, time, type of sport, physical activity
Bäckmand et al. (2006)	BSI	Yes	≥8	LT	Former athletes	Multiple	Elite	N=664	M=64.6 (SD=9.2)	Male	Former athletes vs. non athletes, psychological functioning
Felton & Jowett (2015)	BSI	No	N/A	CS	Current athletes	Not specified	Multiple	N=241	M = 20.74 (SD= 2.23, range 18 to 31 years)	Female n=154 (64%) Male n=87 (36%)	Athlete's attachment style (with coach), athlete's psychological need thwarting (by coach), performance satisfaction, life satisfaction, negative affect
Lancaster et al. (2016)	BSI	No	N/A	LT	Current athletes	Multiple	High school and collegiate /University	N= 2049	M= 15.9 -19.1	Female n= 469, male n= 1522	Gender, education level (university vs. high school), race, previous concussions, internal consistency of scale, test-retest of scale, criterion validity
Spearman-Teamer (2009)	BSI	No	N/A	CS	Current athletes	Multiple	University	N=86	M=20.05 (SD=1.52)	Male	Gender role conflict, male role conflict, racial conflict

Weber et al. (2018)	BSI	No	N/A	CS	Current athletes	Multiple	University	N=8652	M=19.4 (SD=1.4)	Male n=4713 (54.5%), female n=3939 (45.5%)	History of depression, history of anxiety, trait anxiety, somatization, concussion symptoms, balance (physical test), neurocognitive performance
Madler (2009)	CDI	No	N/A	CS	Current athletes	Multiple	Elementary/high school/secondary school	N=137	M=16.12 (SD = 1.22)	Female n=146, male n=186 (56%)	Civilian athletes/non-athletes, military (active duty parent) athletes/non-athletes
Oguz & Oguz (2017)	CDI	No	N/A	CS	Current athletes	Not specified	Elementary/high school/secondary school	Total N=104	Range 9 – 23+	Female 50.2 %	Athlete vs. non-athlete
Oler et al. (1994)	CDI	No	N/A	CS	Current athletes	Multiple	Elementary/high school/secondary school	N=243	M= 16.0 (SD=1.3)	58% male	Athletes vs non-athletes, gender
Appaneal et al. (2009)	CES-D	Yes	>16	LT	Current athletes	Multiple	High school and collegiate /University	N= 164	M = 19.7 (SD = 2.0, range 14 to 24)	Male n=108, female n=56	Time (1 week, 1 month, 3 months post-injury), injured vs. non-injured athletes (matched control sample), gender,

											clinician rated depression
Armstrong & Oomen- Early (2009)	CES-D	Yes	≥ 16	CS	Current athletes	Not specified	University	N=104	Sample (not athlete specific) M= 19.87 years (SD = 1.33 years, range 18 to 24)	(not athlete specific) Female n=136, male n=91	Self-esteem, social connectedness, athletes vs. non athletes, gender, sleep
Bourlas (2013)	CES-D	Yes	≥ 16	CS	Former athletes	American football	Multiple	N= 154	M = 46.7 (SD = 14.5, range 23 to 82)	Male	Age of onset of exposure to American football, normative data
Brewer & Petrie (1995)	CES-D	Yes	16/23	CS	Current athletes	American football	University	N=916	M=19.78 (SD = 1.40)	Male	Injured vs. non injured
Chambers (2004)	CES-D	Yes	Abstract only (N/A)	CS	Both	Ice hockey	Professional	N=238	N/A	Male	Transition to retirement, institutional support, social support, athletic identity, neuroticism, extraversion, openness to experience, agreeableness, conscientiousness, alcohol

											problems, active vs. retired players
Deshpande et al. (2017)	CES-D	No	N/A	LT	Former athletes	Multiple	Elementary/high school/secondary school	Football n=834 Non-contact sport controls n =800	M=64.4 (SD=0.8)	Male	Time (age 54 and 72), football vs. all controls, football vs. non-sport controls, football vs non-collision sport controls, non-collision sport controls vs non-sport controls, Apoc ε4 variant
Dishman et al. (2006)	CES-D	No	N/A	CS	Current athletes	Not specified	Elementary/high school/secondary school	N= 1250 Not athlete specific	M=17.66 (SD = 0.61)	Female	Sport participation
Frank et al. (2017)	CES-D	No	N/A	LT	Current athletes	Multiple	Elite	Cross-sectional N=194. Longitudinal N=92	M = 15.08 (SD = 1.95)	N/A	Burnout, chronic stress
Giannone et al. (2017)	CES-D	No	N/A	LT	Both	Multiple	University	N=72	M=22.1 (SD=1.6)	Male n=18 (25%) Female n=54 (75%)	gender, marital status, employment status, type of sport, hours per week in sport, time (pre-retirement, retirement),

											athletic identity, anxiety
Gross et al. (2017)	CES-D	No	N/A	CS	Current athletes	Multiple	University	N=244	N/A	Male n = 92 (37.7%), Female n = 152 (62.3%)	Socially desirable responding
Gulliver et al. (2015)	CES-D	Yes	≥ 16	CS	Current athletes	Multiple	Elite	N=224	M=24.91 (SD=6.00)	Male n=106, female n=118	Age, gender, injury, relocation for sport
Junge & Fedderman-Demont (2016)	CES-D	Yes	≥ 16	CS	Current athletes	Soccer	Elite	N=471	M=22.3 (SD=4.4), range M = 18.35 - 24.81	Male n=289, female n=182	Level of league, level of play, general population, gender, playing position, injury anxiety
Junge & Prinz (2018)	CES-D	Yes	16–21, >21	CS	Current athletes	Soccer	Multiple	N=290	M=21.5 years old (SD=4.2), range M = 18.5 - 23.3	Female	Age, grew up in country (Germany vs. others), match experience, level of play, starter for team, needed psychotherapy, current general health, playing position, training sessions, injury, general population
Kadooka et al. (2014)	CES-D	No	N/A	CS	Current athletes	Not specified	University	N=42	N/A	Female	Time, cortisol awakening response (car)

Killeya-Jones (2005)	CES-D	No	N/A	CS	Current athletes	American football	University	N=40	M=20.13 (SD=1.52, range 18 to 24)	Male	Student-athlete role discrepancy
Li et al. (2017)	CES-D	Yes	≥16	LT	Current athletes	Multiple	University	Baseline N= 958	18 - 22 +	Male 65.9%	Gender, age, race, BMI, school year, history of injuries, anxiety, time (prospective injury risk from pre-season)
Montenigro et al. (2017)	CES-D	No	N/A	CS	Former athletes	American football	High school and collegiate /University	N=93	M=47.3 (SD=13.9)	Male	Cumulative head impacts, concussion history
Nixdorf et al. (2016)	CES-D	No	N/A	CS	Current athletes	Multiple	Elite	N = 199	M = 14.96 (SD = 1.56)	N/A	Team sport vs. individual sport, group/team cohesion, negative attributions after failure, perfectionism
Nixdorf et al. (2013)	CES-D	Yes	≥ 23	CS	Current athletes	Multiple	Multiple	N= 162	M=23.41 (SD=7.03, range 15 to 53)	Female n=58 (35.80%), male n= 104 (64.20%)	Gender, age, professionals, amateur and junior athletes, injury status, relationships, individual vs team sports, current

											psychological counselling, desire for psychological counselling, chronic stress, stress coping strategies, stress recovery activities
Nylandsted Jensen et al. (2019)	CES-D	No	N/A	CS	Current athletes	Soccer	Elite	N=323	M = 22.08 (SD = 5.15, range 16 to 37 years)	Male	Problematic gambling behaviours
Nylandsted Jensen et al. (2018)	CES-D	Yes	≥16	CS	Current athletes	Soccer	Elite	N=323	M = 22.08 (SD = 5.15, Range 16 to 37)	Male	Age, junior vs. professional athletes, perfectionistic strivings, perfectionistic concerns, competitive anxiety, social phobia
Prinz et al. (2016)	CES-D	Yes	≥16, >21	CS	Both	Soccer	Elite	N=157	M=33.0 (SD=6.25)	Female	Levels at worst times during their football career (retrospective time), age, number of injuries, duration of the football career, time since the end of the

											football career, playing position, reasons for low moods at worst times during career, wanted or needed psychotherapeutic support during their career, levels in the first 2 years after football career (retrospective time), concreteness of future plans
Proctor & Boan-Lenzo (2010)	CES-D	Yes	≥ 16	CS	Current athletes	Baseball	University	N=66	M=20.3 (SD = 2.03)	Male	Task-, avoidance- and emotion-oriented coping, athletes vs. non-athletes
Roiger et al. (2015)	CES-D	Yes	≥ 16	LT	Current athletes	Multiple	University	N=21	M=19.8 (SD= 1.4)	Male n=20, female n=1	Concussed vs. injured (non-concussed) vs. healthy sport matched controls, time (baseline, 1 week, 3 weeks, 3 months post injury)
Kohlstedt (2012)	CES-D	No	≥ 16	CS	Current athletes	Multiple	University	N=294	18 - 22 +	Male (43.5%), female (56.5%)	Varsity student-athletes vs. recreational student-athletes vs. non-athlete

											students, class year, communication, problem solving, health, identity, parent attachment, peer attachment, hyper-competitiveness, athletic identity, race, gender, academic achievement
Smith et al. (2018)	CES-D	Yes	$\geq 16, \geq 23$	LT	Current athletes	Soccer	Elite	N = 108	M = 16.15 (SD = 1.84, range 14 to 21)	Male	Time, perfectionism, burnout
Ware et al. (2018)	CES-D	No	N/A	CS	Both	Multiple; boxing and athlete controls	Multiple	N= 19	M = 44.63 (SD = 9.24, range 26 to 59)	Male	Non-contact sport athletes vs. boxers, microstructural alterations cc subregions = diffusion metrics i.e. fractional anisotropy, mean diffusivity, radial diffusivity
Wolanin et al. (2016)	CES-D	Yes	$\geq 16, \geq 27$	CS	Current athletes	Multiple	University	N= 465	N/A	male n=199 (43.1%), female	Gender, type of sport, time of data collection, year in school

										n=263 (56.9%)	
Yang et al. (2014)	CES-D	Yes	≥16	LT	Current athletes	American football	University	N=330	N/A	Male	Clinically relevant symptoms at enrolment to university, anxiety, injury history, injury hazard over time
Yang et al. (2007)	CES-D	Yes	16/23/27	CS	Current athletes	Multiple	University	N=257	M=20 (SD=1.3)	Male n=167 (65%), female n=90 (35%)	History of clinically diagnosed depression, pain, history of injury, gender, race, school year, state and trait anxiety, residence status
Yang et al. (2015)	CES-D	Yes	≥16	LT	Current athletes	Multiple	University	N= 67 athletes, Nconcussions=71	N/A	Male concussions n=53, female concussions n=18	Time (pre-concussion baseline, 1 week, and 1, 3, 6, and 12 months post-concussion until return to play), baseline depressive symptoms, baseline state anxiety, post-concussion state anxiety, gender, type of sport, race, school year, difficulties with

											current course work
Yang, Schaefer, et al. (2014)	CES-D	Yes	≥ 16	LT	Current athletes	Multiple	University	N= 387	N/A	Male n=397 (66.8%), female n=197 (33.2%)	Returning to play from injury, athletes receiving or not social support from athletic trainers, satisfaction with social support from athletic trainer
Nekvasil (2019)	CES-D-10	No	N/A	CS	Current athletes	Multiple	University	N=154	M = 19.85 (SD = 1.40, range 18 to 25)	Female n=334 (61.7%), male n= 200 (37%), transgender /other n= 7 (1.3%)	Injury/illness status, athletic involvement, risky behaviours, age, BMI, cumulative GPA, athletic identity, academic identity, risky sexual behaviour, illicit drug use, problem alcohol use, disordered eating, social support
Silveira et al. (2017)	CES-D-10	Yes	10	CS	Current athletes	Wheelchair rugby	Multiple	N=150	M= 34.7 (SD=8.56)	Male	Training frequency, income, age, race, education, employment, marital status, number of people living in household, time post injury

											(tetraplegia), type of injury, international wheelchair rugby federation functional classification
McFadden et al. (2016)	CES-DC	No	N/A	CS	Current athletes	Ice hockey	Multiple	N=61	M=14.90 (SD = 1.41)	Male	Early specializers, late specializers, recreational athletes, psychological needs satisfaction, psychological needs dissatisfaction, mental health
Beable et al. (2017)	CESD-R	Yes	$\geq 16, \geq 23$	CS	Current athletes	Multiple	Elite	N=187	18 -30+	Female 60.43%	Gender, type of sport, relocation, family history of mood illness, recent injury, employment status, planning retirement, life stress
Ramaeker & Petrie (2019)	CESD-R	No	N/A	CS	Current athletes	Multiple	University	N=220	M=20.03 (SD =1.38)	Male	Conformity to masculine norms (subscales), gender role conflict (subscales).

Bardhoshi et al. (2016)	DASS-21	No	N/A	CS	Current athletes	Not specified	Olympic (senior)	N=383	M= 67.29 (SD=9.22)	Male 55%	Senior game athletes vs. normative data, exercise practices, gender, income, relationship, education, employment, comorbid health conditions
Demirel (2016)	DASS-21	No	N/A	CS	Current athletes	Not specified	University	N=79	Female M = 21.44 (SD = 1.91) Male M= 12.44 (SD = 1.73)	Female n=29, male n= 52	Athletes vs. non-athletes, individual vs. team sports
Drew & Matthews (2018)	DASS-21	No	N/A	CS	Current athletes	Multiple	Multiple	N=185	M = 20.77 (SD = 2.50)	Female 35%	Gender, competition level, help-seeking, Resilience
Drew et al. (2017)	DASS-21	Yes	$\geq 10, \geq 14$	CS	Current athletes	Multiple	Olympic	N=81	M=25.4 (SD=6.2)	Male n = 26, female n= 55	Illness (missing training due to medical illness)
Drew et al. (2018)	DASS-21	No	>4	CS	Current athletes	Multiple	Olympic	N=132	Male M= 25.8 (SD=4.1), female M=24.3 (SD= 3.9)	male n=47, female n=85	Upper respiratory illness, chest symptoms, bodily aches, gastrointestinal symptoms, head symptoms fatigue

De Francisco et al. (2016)	DASS-21	Yes	>4	CS	Current athletes	Multiple	Multiple	N=453	M = 18.94 (SD = 3.85, range 13 to 29)	male 68.7%, female 31.3%	Stress, burn-out
Glass et al. (2019)	DASS-21	No	N/A	RCT	Current athletes	Multiple	University	N=52 (intervention n=23, waitlist control n=29)	M=19.32 (SD = 1.25)	Female n=44 (85%)	MSPE vs. Control, time,
Gomes et al. (2017)	DASS-21	Yes	N/A	CS	Current athletes	Multiple	Amateur	N=309	M=14.2 (SD= 2.1, range 10 to 19)	Male 57.6 %	Sleep quality
Goodman et al. (2014)	DASS-21	No	N/A	IV	Current athletes	Multiple	University	N=26	Experimental M= 20.08 (SD =1.26), control M=20.38 (SD =1.80)	Male	Athletes in mindfulness intervention vs. control, time (pre-post)
Silva et al. (2017)	DASS-21	Yes	N/A	CS	Current athletes	Multiple	Amateur	N=310	Male=14.59 (SD= 2.15) Female= 13.58 (SD=1.95)	Female n=131, male n=179	Gender, age, BMI, individual vs. team sport, practice time, training frequency, duration of training sessions,

									Range 10 to 19		neck/shoulder pain
Van Lier & Raes (2018)	DASS-21	No	>14	CS	Current athletes	Multiple	Multiple	N=668	M= 27.57 (SD = 12.37, range: 16 to 75)	Male and female	Positive/negative generalizations over future performance, self- concept.
Bakhshalip our et al. (2016)	GHQ-28	No	N/A	CS	Current athletes	Not specified	Universit y	N=240	N/A	Male	Athletes vs. nonathletes
Bano (2014)	GHQ-28	No	N/A	CS	Current athletes	Not specified	Universit y	N=125	21-26 years	Male	Athletes and non- athletes
Çelebi et al. (2015)	HADS	Yes	>7	LT	Current athletes	Not specified	Professio nal	N=38	M=26.8 4 (SD=8.0 3)	Male n=35 males, female n=3	Time (post- operation, six weeks post- operation)
Scott et al. (2019)	HADS	No	8–10, 11–14, 15+	CS	Current athletes	Multiple	Multiple	N=1172	M= 24.04 (SD = 9.96)	Female n= 727	Gender, eating psychopathology, compulsive exercise
Weber et al. (2018)	HADS	Yes	0–7, 8–10, 11–21. AND 0–6, 7– 9, 10– 21	CS	Current athletes	Multiple	Multiple	N=326	M=14.3 (SD=1.6 , range 12 to 18)	Male n=155, Female=17 1	Anxiety, age, gender
Weber et al., (2018)	HADS	Yes	0–7, 8–10, 11–21	LT	Current athletes	Multiple	Universit y	N=244	M= 19.4 (SD= 1.43)	Male n= 132, female n= 112	Concussion history, time (baseline, 24–48 h, asymptomatic,

											return-to-play, 6-month)
Jewett et al. (2014)	MDI	No	N/A	LT	Not reported	Multiple	Elementary/high school/secondary school	N= 853	M= 20.39 (SD= .75)	Female n=462 (54.1 %)	Gender, age, parent education, diagnosed mood disorder, extracurricular sport, school sport participation
Villarreal-Ángeles et al. (2017)	MDI	No	N/A	CS	Current athletes	Multiple	University	N=198	Female M=20.22 (SD=2.55) Male M=20.28 (SD=1.65)	Male n = 85, female n = 113	Gender, individual vs. team sports
Raut Tanuja & Ahmad (2015)	MHI-38	No	N/A	CS	Current athletes	Not specified	University	N=20	N/A	Male	Athletes vs. non-athletes
López (2008)	PAI	No	N/A	CS	Current athletes	Multiple	University	N=165	M=20.07 (SD = 1.48)	Female n= 111, 67.3%	Gender, injury, injury characteristics, student-athlete role behaviours
Storch et al. (2005)	PAI	Yes	>32	CS	Current athletes	Multiple	University	N=105	M= 20.9 (SD =3.0, range 17 to 41)	Female 66.5%	Gender, athlete vs. non-athlete

Storch et al. (2002)	PAI	No	N/A	CS	Current athletes	Multiple	University	N=105	M=19 years 9 months (SD = 19 months)	Male and female	Age, gender, religion
Belz et al. (2018)	PHQ-2	Yes	≥ 3	CS	Current athletes	Multiple	Multiple	N=154	M=18.81 (SD = 5.05)	Female 51%	Age, gender, back pain intensity, back pain disability
Belz, Kleinert, et al. (2018)	PHQ-2	Yes	≥ 3	CS	Current athletes	Multiple	Multiple	N=1799	M=21.51 (SD = 6.52 years, range 16 to 59)	Female 54%	Age, gender, performance level
Buck et al. (2018)	PHQ-2	Yes	N/A	CS	Current athletes	Ultra-marathon	Amateur	N= 98	M=38.4 (SD=8.9, range 21 to 64)	Male 60.2%	Age, gender, spirituality, relationship status, race completion status, race completion time
Ohlert et al. (2019)	PHQ-2	No	N/A	CS	Current athletes	Multiple	Multiple	N= 1529	M= 21.6 years (SD = 6.7, range 16 to 59)	Female 56%	Interpersonal violence, overall sexual violence experiences, and sexual violence experiences within and/or outside of sport.
Bell et al. (2016)	PHQ-9	Yes	≥ 10	CS	Current athletes	Not specified	Elementary/high school/se	N=102	M=15.7 (SD=1.4)	Female n=58, male= 44	Headache severity post-concussion

							condary school		, range 14 to 19)		
Chen et al. (2019)	PHQ-9	No	N/A	IV	Current athletes	Baseball	Elite	N=21	M=26.38 (SD=2.60, range 22 to 30)	Male	Time (baseline, time 1, and time 2 post-intervention)
Decq et al. (2016)	PHQ-9	Yes	≥10	CS	Former athletes	Multiple; Rugby and athlete controls	Multiple	N=377 (rugby n= 239, another sports n= 138)	Rugby M=52 (range 49 to 55.75), other sports M=52 (range 49 to 55)	Male	Retired rugby players vs. retired other sports, number of concussions, history of depressive episodes, perceived state of health
Fraser (2016)	PHQ-9	No	N/A	CS	Current athletes	Multiple	Elementary/high school/secondary school	N=1190	M=15.59 (SD=1.21)	Male and female	Concussion history, American football vs. other sports, gender, time (pre-season to post-season), concussed vs. non-concussed
Fraser (2016)	PHQ-9	No	N/A	LT	Current athletes	American football	Elementary/high school/secondary school	N=275	M=15.83 (SD=1.10)	Male	Concussion history, time (change scores), Competition Impact Severity Profiles
Gerber et al. (2018)	PHQ-9	No	N/A	LT	Current athletes	Multiple	Elite	Baseline N=257 Follow	M = 16.8 (SD = 1.4,	Male and female	Burnout symptoms, perceived stress,

								up N=197	baseline range 14 to 24)		satisfaction with life
Gerber, Best, et al. (2018)	PHQ-9	Yes	> 14	LT	Current athletes	Multiple	Elite	Baseline n=257 Follow= up n=197	Baseline M = 16.82 years (SD = 1.44; range: 14–22 years)	Male and female	Age, gender, training load, years in competitive sport, injury, medication, perceived stress, mental toughness, burnout symptoms, time
Kerr et al. (2014)	PHQ-9	Yes	≥10	CS	Former athletes	Multiple	Universit y	N= 797	29 or younger - 45 +	Male n=376, female n=421	Number of concussions
Kerr et al. (2018)	PHQ-9	Yes	≥10	CS	Former athletes	American football	Universit y	N= 204	33 or younger - 38+	Male	Concussion history, BMI
Kraus et al. (2018)	PHQ-9	No	N/A	CS	Current athletes	Rowing	Multiple	N=113	M=21.1 9 (SD = 6.20, range 12 to 46)	Male and female	Performance levels, weight class
McGuire (2014)	PHQ-9	Yes	5-9, 10 -14, 15- 19, 20- 27	LT	Current athletes	Multiple	Universit y	N=644	18 - 25+	male n = 475 (73.8%), female n = 169 (26.2%)	Time (baseline + 6 follow-up time points), time (pre- and post- concussion), difficulty dealing with symptoms, gender, age, race, sport, level of

											sport (NCAA division), negative life events, history of concussion, neurocognitive performance
McGuire et al. (2017)	PHQ-9	Yes	≥ 10	LT	Current athletes	Multiple	University	N=93	M=19.86 (SD=1.63)	Male 63.4% Female 36.6%	Time (athletic season), gender, type of sport, level of school
Du Preez et al. (2017)	PHQ-9	Yes	≥ 10	CS	Current athletes	Rugby	Multiple	Pre-season N= 404, In-season N=278	Preseason M=21.4 (SD= 3.6) Inseason M=21.5 (SD= 4.0)	Male	Time of measurement (pre- or in-season), ethnicity, age, injury, number of concussions, history of mental illness
Putukian et al. (2018)	PHQ-9	No	N/A	LT	Current athletes	Multiple	University	N=1152	M= 19.42 (SD= 1.35)	Male 69%	Prospective concussion incidence, those with concussion diagnosis vs. not, depression also tested as predictor of recovery time.
Schwenk et al. (2007)	PHQ-9	Yes	≥ 10	CS	Former athletes	American football	Professional	N=1617	M=53.4 (SD=14.5)	Male	Difficulty finding employment, difficulty finding satisfaction in work, limited or no health insurance

											coverage, financial difficulties relationship or marital problems, lack of social support or friendships, loss of a sense of being part of a community or a ‘part of the team’, trouble with transition to life after professional football, difficulty with pain, difficulty with aging, the use of prescribed medication, alcohol, or other drugs, trouble sleeping, loss of fitness and lack of exercise, weight gain, barriers to help seeking, pain
Silva-Rocha et al. (2019)	PHQ-9	Yes	≥ 10	CS	Current athletes	Multiple	Multiple	N=238	M = 22.9 (SD= 7.9)	Male n=169, female n=69	sport anxiety, state-trait anxiety, social phobia, competitive state anxiety
Tahtinen &	PHQ-9	Yes	≥ 10	CS	Current athletes	Multiple	Multiple	N=187	18+	Individual sport male	Individual sport athletes vs. non

Kristjansdottir (2019)										n = 85, individual sport female n = 97	athlete, help-seeking intentions, gender, anxiety
Turner et al. (2019)	PHQ-9	No	N/A	CS	Current athletes	Multiple	Multiple	N= 214	M = 42.24 (SD = 10.54, range 18 to 72)	Male and female	Irrational beliefs, maladaptive schemas, anxiety and psychological stress
Videnova et al. (2016)	PHQ-9	Yes	≥10	CS	Current athletes	Not specified	University	N=71	M=19 (range 18 to 20)	Male n=42, female n=29	Athletes vs. medical students, gender
Hunter et al. (2018)	PROMIS	No	N/A	LT	Current athletes	Soccer	Amateur	N=272	M= 25.9 (SD=7.8)	Male n=207 (76%), female n=65 (24%)	Two-week headers, 2-week unintentional impacts, 12-mo. headers, lifetime concussion.
Oosterhoff et al. (2018)	PROMIS	Yes	SD= 1 or higher	CS	Current athletes	Multiple	Amateur	N=54 athlete-parent dyads	M= 16 (SD= 1.6)	Male n=36 Female n=18	Parent vs. child reports of depressive symptoms, population norm
Simon & Docherty (2014)	PROMIS	No	N/A	CS	Former athletes	Multiple	University	N=232	M= 53.36 (SD= 7.11)	Male n=167, female n= 65	Former division I athletes vs. non-athletes, population norm
Sheehan et al. (2018)	QIDS-SR	Yes	0–5, 6–10, 11–15, 16–	LT	Current athletes	Multiple; Gaelic games	University	N=38	M= 19.97 (SD=1.60)	Male n= 20, Female n= 18	Gender, time, total mood disturbance, sleep quality, trait anxiety, intrinsic

			20, 21-27								motivation, extrinsic motivation, amotivation, competence, autonomy, relatedness, task/ego climate
Sheehan et al. (2018a)	QIDS-SR	Yes	0-5, 6-10, 11-15, 16-20, 21-27	CS	Current athletes	Multiple	Elite	N = 215	M = 22.8 (SD = 4.1, range 18 to 37)	Female 65% Male 35%	Sport motivation, basic need satisfaction, perceived motivational climate, mood states, sleep quality, state and trait anxiety
Bostani & Saiiari (2011)	SCL- 90-R	No	N/A	CS	Current athletes	Not specified	University	N=100	M=26.42 (SD=1.48)	Male	Athletes vs. non-athletes
Hussey et al. (2019)	SCL- 90-R	No	N/A	CS	Current athletes	Not specified	University	N=85	M= 20.4 (SD = 2.2)	Male n = 44 (51.8%)	Difference between levels (intramural, club, NCAA I), gender, parental influences - general pressure, poor relationship and lack of support, pressure to quit or continue unsafely, and embarrassing

											comments and negative attitude
Jowett & Cramer (2009)	SCL- 90-R	No	N/A	CS	Current athletes	Multiple	Elite	N=87	M= 26.71 (SD = 7.29, range 18 to 56)	Female n=48, male n= 39	Interpersonal trust, interpersonal commitment, hostile interactions, communication quantity, negative spill over, sport satisfaction
Klinkowski et al. (2008)	SCL- 90-R	No	N/A	CS	Current athletes	Rhythmic gymnastics	Elite	N=51	M= 15.2 (range 12 to 18)	Female	Anorexia nervosa patients vs. elite rhythmic gymnasts vs. high school students
Shanmugam et al. (2014)	SCL- 90-R	No	N/A	LT	Current athletes	Multiple	Multiple	N=122	M=21.2 2 years (SD = 4.02, range 17 to 36)	Male n=36, female n=86	Time, eating psychopathology
Wang et al. (2017)	SCL- 90-R	No	N/A	LT	Current athletes	Multiple	Elementary/high school/secondary school	N=1065	N/A	Male 49%	Time (symptoms grade 9-12), team and individual sport participation
Sanders & Stevinson (2017)	SDHS	Yes	<10	CS	Former athletes	Soccer	Multiple	N= 307	M= 46.8 (15.7)	Male	Age, athletic identity, psychological well-being, duration of playing career,

											highest level played, age at retirement, time since retirement, reasons for retirement, presence of injury-related pain, intensity of injury-related pain
Thirer et al. (1987)	Self-Rating Depression Scale	No	N/A	CS	Current athletes	Not specified	University	N=43	N/A	Male	Athletes vs. non-athletes
Turner et al. (2019)	STPI	No	N/A	CS	Current athletes	Multiple	Multiple	Elite n=127 Recreational n=174	M=27.16 (SD=10.50, range 14 to 70)	Male and female	Elite vs. recreational vs. non-athlete, gender, type of sport, irrational beliefs, age, gender across sport level
Hagiwara et al. (2017)	Stress Response Scale for Athletes - depression scale	No	N/A	CS	Current athletes	Multiple	University	N=204	M=20.24 (SD=1.24)	Male n=105, female n=99	Gender, receiving and providing social support with teammates
Brand et al. (2010)	The Depression Scale	No	N/A	CS	Current athletes	Multiple	Elite	N=258	Females M = 17.0 (SD=1.3),	female n=139, male n=119	Gender, athletes vs. non athletes, sleep quality

									Males M=16.9 (SD =1.4)		
Weigand et al. (2013)	Wakefield Depression Scale	Yes	≥15	CS	Both	Multiple	University	Total N=280 Current n= 163 Former n= 117	18 - 23+	Male and female	Current vs. graduated, retired athletes

Note. BDSA= Baron Depression Screener For Athletes, BDI = Beck Depression Inventory, BDI-FS = Beck Depression Inventory-Fast Screen, BDI-SF= Beck Depression Inventory Short Form, BSI= Brief Symptom Inventory, CDI= Children’s Depression Inventory, CES-D= Center for Epidemiologic Studies Depression Scale, CES-DC= Center for Epidemiologic Studies Depression Scale, CESD-R= Center for Epidemiologic Studies Depression Scale Revised, CDC= Children's Depression Scale, DASS-21= Depression Anxiety and Stress Scale, SDHS= Short Depression-Happiness Scale, Zung = Zung Self-Rating Depression Scale, GHQ-28 = General Health Questionnaire, HADS= Hospital Anxiety Depression Scale, MDI= Major Depression Inventory, MHI= Mental Health Inventory, PAI= Personality Assessment Inventory, PHQ = Patient Health Questionnaire, PROMIS= Patient-Reported Outcomes Measurement Information System, QIDS-SR= Quick Inventory of Depressive Symptomatology-Self-Report, SCL-90-R = Symptom Checklist Revised, STPI= State Trait Personality Inventory.

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