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Depression and stress in German competitive athletes: From basic research to preventive interventions for adolescent athletes

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Hereby I declare:

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I further declare that I complied with the actual "guidelines of qualified scientific work" of the German Sport University Cologne.

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Date, Signature

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List of publications

The research carried out as part of this cumulative dissertation project resulted in three peer-reviewed publications:

Publication 1	Belz, J., Kleinert, J., Ohlert, J., Rau, T., & Allroggen, M. (2018). Risk for depression and psychological well-being in German national and state team athletes – Associations with age, gender, and performance level. *Journal of Clinical Sport Psychology*, *12*(2), 160–178. doi:10.1123/jcsp.2016-0024
Publication 2	Belz, J., Heidari, J., Levenig, C., Hasenbring, M., Kellmann, M., & Kleinert, J. (2018). Stress and risk for depression in athletes suffering from back pain: Do age and gender matter? *European Journal of Sport Science*, *18*(7), 1029–1037. doi:10.1080/17461391.2018.1468482
Publication 3	Belz, J., Kleinert, J., & Anderten, M. (2020). One shot—no hit? Evaluation of a stress-prevention workshop for adolescent soccer players in a randomized controlled trial. *The Sport Psychologist*, 1–11. doi:10.1123/tsp.2019-0106

Abstract

Depression is a common mental health disorder among competitive athletes that can have detrimental consequences including performance-decline, premature career-dropout, and even suicide. Athletes have been found to be as susceptible to depressive symptoms as non-athletes, and stress has repeatedly been linked to depression in the context of competitive sports. Based on the serious potential consequences of depression in competitive sports, the present dissertation explores depression and stress, and factors associated therewith, in German competitive athletes.

An overview of the current body of literature reveals that existing prevalence studies on depression report a broad range of prevalence rates and inconsistent findings regarding the association between depressive symptomatology and demographic variables (e.g., age, level of sport performance). Several of the existing prevalence studies are further characterized by methodological limitations, such as small and unrepresentative sample sizes, and the disregard of the adolescent athlete population. With the intention of addressing the aforementioned limitations of, and research gaps in, prior studies, the aim of study I of this dissertation is the investigation of the prevalence of depressive symptoms in a comprehensive sample of German competitive athletes. A special focus is placed on the examination of the association between the demographic variables age, gender, and level of sport performance and the prevalence of depressive symptomatology. Study I reveals that of 1,799 German competitive athletes, 13.4% were screened positively for depression and 10.2% for impairments in psychological well-being. Adolescent age, female gender, and junior national team status were identified as risk factors for depressive symptoms.

For the general population, empirical support for the relationship between depression, stress, and back pain is extensive. Despite the fact that back pain is a widespread issue in competitive sports with adverse performance and (mental) health outcomes for athletes, the relationship between the factor back pain and the psychosocial variables depression and stress has hardly received any scientific attention in competitive sports. To close this research gap, study II of this dissertation investigates the relationship between depression, stress, and back pain in German competitive athletes. Study II reveals that depression and stress are associated with back pain parameters in a population of 154 competitive athletes with back pain. In particular, stress could be linked to pain intensity and depression to pain-related disability.

A multitude of empirical findings supports the assumption that adolescence is a sensitive period for the experience of stress and stress-related mental (e.g., depression) and physical (e.g., back pain) health outcomes. In order to transfer knowledge derived from empirical findings and theoretical frameworks to the applied work with competitive athletes, the aim of study III is to develop, implement, and evaluate a theory-based stress-prevention intervention for 92 adolescent soccer players through a randomized controlled trial. The intervention was evaluated on its effectiveness regarding stress, coping, and depression parameters and on its perceived usefulness according to the athletes. No intervention effects on stress, coping, and depression emerged. Notwithstanding, the athletes perceived the stress-prevention intervention to be useful, especially with regard to the improvement of their performance and well-being.

This dissertation provides new insights into depression, stress, and factors associated therewith in competitive sports by means of basic research via cross-sectional designs (study I and study II) and a longitudinal preventive intervention study (study III). Considering the average prevalence rate across all three studies, every 10th German competitive athlete was screened positively for depressive symptoms. This observed prevalence rate of depressive symptoms in competitive athletes is akin to the prevalence rate detected in the general German population. This dissertation further indicates that adolescent athletes seem to be more vulnerable to depressive symptomatology than other age groups. Forthcoming studies should consider investigating the mechanisms of stress and stress-related conditions in competitive sports to improve the understanding of their etiology and to deduce effective preventive interventions for the context of competitive sports in general, and for the adolescent athlete population in particular.

Zusammenfassung

Die Depression ist eine häufige Erkrankung unter Leistungssportler*innen und kann mit schwerwiegenden Konsequenzen wie einem drastischen Leistungsabfall, einem vorzeitigen Karriereende oder sogar einem Suizid einhergehen. Es hat sich gezeigt, dass Sportler*innen genauso anfällig für depressive Symptome sind wie Nicht-Sportler*innen, und im Leistungssport wurde Stress wiederholt mit depressiver Symptomatik in Verbindung gebracht. Ausgehend von den alarmierenden möglichen Folgen von Depressionen im Leistungssport werden in der vorliegenden Dissertation depressive Symptomatik und Stress sowie damit verbundene Faktoren bei deutschen Leistungssportler*innen untersucht.

Ein Überblick über den aktuellen Stand der Literatur zeigt, dass bestehende Prävalenzstudien zu Depressionen ein breites Spektrum an Prävalenzraten und inkonsistente Befunde bezüglich des Zusammenhangs zwischen depressiver Symptomatik und demographischen Variablen (z.B. Alter, sportliches Leistungsniveau) aufweisen. Mehrere der existierenden Prävalenzstudien sind zudem durch methodische Limitationen, wie kleine und nicht repräsentative Stichproben, und die fehlende Berücksichtigung von jugendlichen Leistungssportler*innen gekennzeichnet. Um sich mit den genannten Limitationen und Forschungslücken zu befassen, ist das Ziel von Studie I dieser Dissertation die Untersuchung der Prävalenz depressiver Symptome in einer umfangreichen Stichprobe deutscher Leistungssportler*innen. Ein besonderer Schwerpunkt liegt dabei auf der Untersuchung des Zusammenhangs zwischen der Prävalenz depressiver Symptome und den demographischen Variablen Alter, Geschlecht und sportliches Leistungsniveau. Studie I ergab, dass von 1799 deutschen Leistungssportler*innen 13,4% depressive Symptome und 10,2% Beeinträchtigungen des psychischen Wohlbefindens zeigten. Als Risikofaktoren für depressive Symptomatik wurden das Jugendalter, das weibliche Geschlecht und das sportliche Leistungsniveau der Junioren-Nationalmannschaft identifiziert.

In der Allgemeinbevölkerung gibt es umfassende empirische Evidenz für den Zusammenhang zwischen Depressionen, Stress und Rückenschmerzen. Trotz der Tatsache, dass Rückenschmerzen im Leistungssport ein weit verbreitetes Problem mit negativen Auswirkungen auf die Leistungsfähigkeit und die (psychische) Gesundheit der Athlet*innen sind, hat der Zusammenhang zwischen Rückenschmerzen und den psychosozialen Variablen Depressionen und Stress im Leistungssport bisher kaum wissenschaftliche Aufmerksamkeit erfahren. Um diese Forschungslücke zu schließen, wird in Studie II dieser Dissertation der

Zusammenhang zwischen Depressionen, Stress und Rückenschmerzen bei deutschen Leistungssportler*innen untersucht. Studie II zeigte, dass bei einer Stichprobe von 154 Leistungssportler*innen depressive Symptome und Stress mit Rückenschmerzparametern assoziiert waren. Insbesondere konnten Stress mit Schmerzintensität und depressive Symptome mit schmerzbezogener Beeinträchtigung in Verbindung gebracht werden.

Eine Vielzahl empirischer Befunde unterstützt die Annahme, dass das Jugendalter eine sensible Zeit für das Erleben von Stress und stressbedingten psychischen (z.B. Depressionen) und physischen (z.B. Rückenschmerzen) Gesundheitsfolgen ist. Um das aus empirischen Befunden und theoretischen Grundlagen gewonnene Wissen auf die angewandte Arbeit mit Leistungssportler*innen zu übertragen, ist das Ziel von Studie III die Entwicklung, Durchführung und Evaluation einer theoriebasierten Stresspräventionsintervention für jugendliche Fußballspieler*innen in einer randomisiert-kontrollierten Studie. Die Evaluation der Intervention bezog sich auf die Beurteilung der Wirksamkeit der Intervention in Bezug auf Stress-, Bewältigungs- und Depressionsparameter sowie auf die von den Athlet*innen wahrgenommene Nützlichkeit der Intervention. Es traten keine Interventionseffekte bezüglich Stress, Bewältigungsfähigkeiten und depressiven Symptomen auf. Dessen ungeachtet empfanden die Athlet*innen die Stresspräventionsintervention als nützlich, insbesondere im Hinblick auf die Verbesserung ihrer Leistung und ihres Wohlbefindens.

Die vorliegende Dissertation kann mittels Grundlagenforschung über Querschnittsdesigns (Studie I und Studie II) und einer längsschnittlichen präventiven Interventionsstudie (Studie III) neue Erkenntnisse über Depressionen, Stress und damit verbundene Faktoren im Leistungssport liefern. Betrachtet man die durchschnittliche Prävalenzrate über alle drei Studien hinweg, so wurde jede/r zehnte deutsche Leistungssportler*in positiv auf depressive Symptome untersucht. Diese beobachtete Prävalenzrate bei Leistungssportler*innen entspricht der Prävalenzrate, die auch in der deutschen Allgemeinbevölkerung festgestellt wurde. Diese Dissertation legt außerdem nahe, dass jugendliche Leistungssportler*innen offenbar anfälliger für depressive Symptome sind als andere Altersgruppen. Zukünftige Studien sollten in Betracht ziehen, die Mechanismen von Stress und stressbedingten Gesundheitsfolgen (z.B. Depressionen) im Leistungssport zu untersuchen, um das Verständnis für deren Entstehung zu verbessern und um effektive präventive Interventionen für den Kontext Leistungssport im Allgemeinen und für jugendliche Leistungssportler*innen im Besonderen entwickeln zu können.

Abbreviations

APA	American Psychological Association
BDI-2	Beck Depression Inventory-2
BP	Back pain
CES-D	Center for Epidemiologic Studies Depression Scale
CIS-D	Composite International Diagnostic-Screener
CPG	Chronic Pain Grade
DesTeen	Depression Screener for Teenager (Depressionsscreener für Teenager)
DOSB	German Olympic Sports Federation (Deutscher Olympischer Sportbund)
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders-IV
DSM-IV-TR	Diagnostic and Statistical Manual of Mental Disorders-IV-Text Revision
DSM-5	Diagnostic and Statistical Manual of Mental Disorders-5
FEPSAC	European Federation of Sport Psychology
FIFPro	World Footballers' Union
GHQ-12	General Health Questionnaire-12
ICD-10	The ICD-10 Classification of Mental and Behavioural Disorders
ICG	Intervention control group
IG	Intervention group
IOC	International Olympic Committee
ISSP	International Society of Sport Psychology
MANCOVA	Multivariate analysis of covariance
NCAA	National Collegiate Athletic Association
PAI	Personality Assessment Inventory
PHQ-2	Patient-Health-Questionnaire-2
PHQ-8	Patient-Health-Questionnaire-8

PMR	Progressive Muscle Relaxation
PSQ	Perceived Stress Questionnaire
QS17	QS17 Inventory
RCT	Randomized controlled trial
RESTQ	Recovery-Stress-Questionnaire-Basic-24
SPC	Sport psychology consultant
WDI	Wakefield Self-assessment Depression Inventory
WHO-5	WHO-Five Well-Being Index

1 Introduction

The year 2019 marked the 10th anniversary of the suicide of German national soccer goalkeeper Robert Enke. Enke, an exceptionally talented and successful athlete who won eight international titles with the German national team, took his own life after years of battling with depression. Enke's case serves as compelling evidence that even successful athletes are susceptible to one of society's greatest problems – depression (Mummery, 2005). During the past decade, the topic of depression in competitive sports has drawn increasing public attention (Kuettel & Larsen, 2019; Walton, Purcell, & Rice, 2019), and several athletes have addressed their struggles with depression in the media. Examples of affected athletes include Michael Phelps, an American former competitive swimmer and the most decorated Olympian of all time, and Lindsey Vonn, an American former World Cup alpine ski racer on the US Ski Team. What does being depressed mean? Individuals affected by depression experience symptoms including lack of interest, impaired mood, sleep disturbances, changes in appetite, and low self-worth (American Psychiatric Association, 2013; Mummery, 2005). In the long term, these symptoms can impair the ability of an individual to attend to everyday activities and can even lead to suicide, as in the case of Enke.

Athletes seem to be as susceptible to depressive symptoms as non-athletes, according to a recent meta-analysis (Gorczynski, Coyle, & Gibson, 2017) and a systematic review (Rice et al., 2016). This finding seems paradoxical, as the positive impact of physical activity and exercise on aspects of mental health has been empirically validated (Belz, Chermette, Raven, & Kleinert, 2020; Biddle & Mutrie, 2008). In particular, physical activity and exercise have been found to reduce negative affect (Cooney et al., 2013), decrease stress levels (Klaperski, 2018), enhance mood, and elevate psychological well-being in individuals (Conn, 2010; Cooney et al., 2013; Mammen & Faulkner, 2013). However, competitive athletes are not immune to depression (Mummery, 2005), as illustrated by the famous cases of Enke, Phelps, and Vonn.

The heightened public focus on mental health in general, and depression in particular, in the world of sport has been accompanied by a drastic increase in academic interest (Kuettel & Larsen, 2019; Poucher, Tamminen, Kerr, & Cairney, 2019), as illustrated by the recently published international consensus and position statements of the International Society of Sport Psychology (ISSP; Schinke, Stambulova, Si, & Moore, 2018), the European Federation of Sport Psychology (FEPSAC; Moesch et al., 2018), and the International Olympic Committee (IOC;

Reardon et al., 2019). In short, these consensus and position statements propose that mental health symptoms and disorders should be regarded "in a similar light as other medical illnesses and musculoskeletal injuries" (Reardon et al., 2019, p. 687) and are intended to spark further discussions on "how to make athletes healthier and, thus, more resourceful for (and through) sport" (Schinke et al., 2018, p. 622). Finally, stakeholders in competitive sports are encouraged to optimize their support systems for mental health disorders (Moesch et al., 2018).

Despite the increasing scientific coverage of mental health and depression in competitive sports, the general cause of depression in athletes is still unclear (Mummery, 2005). Stress, however, has repeatedly been linked to depression, both inside and outside the sport context (e.g., Frank, Nixdorf, & Beckmann, 2015; Hammen, Kim, Eberhart, & Brennan, 2009; Mummery, 2005). In addition to the exposure to universal stressors, athletes are confronted with a variety of stressors specific to the context of competitive sports, potentially increasing their vulnerability to depression (Kuettel & Larsen, 2019; Rice et al., 2016). For example, sport-specific stressors include extensive training loads, pressure to perform well, public scrutiny, and the constant fear of suffering from a career-ending injury (Arnold & Fletcher, 2012; Hill, MacNamara, Collins, & Rodgers, 2016; Rice et al., 2016). The ways in which athletes cope with stress can decidedly affect their physical and their mental health (Mummery, 2005). To illustrate, high stress experienced in competitive sports has not only been linked to depression (Frank et al., 2015), but also to performance decline, premature career-dropout (Schinke et al., 2018), fatigue, impaired recovery (Frank, Nixdorf, & Beckmann, 2018), injuries, and back pain (Galambos, Terry, Moyle, Locke, & Lane, 2005).

Based on the alarming potential consequences of depression and stress in competitive sports, the present dissertation explores depression and stress, and factors associated therewith, in German competitive athletes. The general introduction in chapter 1 establishes the empirical and theoretical foundation on which the three peer-reviewed publications that constitute the main part of this dissertation are based. The introduction consists of four sections: first, a brief overview of the current empirical knowledge on depression and stress in competitive sports is provided. Subsequently, empirical findings and two theoretical frameworks, the transactional model of stress and coping (henceforth referred to as the "transactional model"; Lazarus & Folkman, 1984) and the biopsychosocial model (Engel, 1977), are presented to examine the connection between the two constructs more closely. The second section investigates the link between the variables stress, depression, and back pain in competitive sports. In this section, the current understanding of the connection between depression, stress, and back pain in and

outside of the competitive sport context is discussed in light of the aforementioned theoretical models. Third, a case is made for the development, execution, and evaluation of a stress-prevention intervention for adolescent competitive athletes. The fourth section presents the aims of the present dissertation. Subsequently, chapter 2 comprises the dissertation's three published peer-reviewed articles. Finally, chapter 3 completes this dissertation by discussing the main research findings and inferred implications for theory and practice as well as strengths, limitations, and future directions.

1.1 Depression and stress in competitive sports

Despite the growing public and scientific interest in depression among competitive athletes (Kuettel & Larsen, 2019; Walton et al., 2019), empirical data on depression and underlying factors in competitive sports is still sparse (Nixdorf, Frank, & Beckmann, 2015). Stress is thought to greatly contribute to the etiology and manifestation of depression both in the general population and in the sport context (e.g., Frank et al., 2015; Monroe & Reid, 2009; Nixdorf, Frank, Hautzinger, & Beckmann, 2013). However, further knowledge concerning the relationship between depression and stress and factors affiliated therewith is still needed in the sport setting (Frank et al., 2015; Nixdorf et al., 2015).

1.1.1 Prevalence of depression in competitive sports

To better understand the pervasiveness of depression in competitive sports, the following section provides a short summary of prevalence studies on depression and discusses gaps in research critically (for a more detailed overview, refer to Belz, Kleinert, Ohlert, Rau, & Allroggen, 2018). The publication of several reviews on depression in high-performance sports (e.g., Frank et al., 2015; Reardon & Factor, 2010; Rice et al., 2016; Wolanin, Gross, & Hong, 2015) mirrors the growing scientific interest in this topic. When evaluating these prevalence rates, however, it should be considered whether prevalence studies investigate major depressive disorder or depressive symptoms (Belz, Kleinert et al., 2018; Hong, Wolanin, & Gross, 2015; Schuch, 2015). To illustrate, major depressive disorder is commonly diagnosed by a clinician and is based on the fulfillment of criteria according to manuals such as the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5; American Psychiatric Association, 2013). In contrast, the terms "depressive symptoms", "symptoms of depression", or "risk for depression" frequently refer to a subclinical condition in which the same or similar symptoms

are experienced as in major depressive disorder, but the symptomatology does not meet the diagnostic criteria necessary for a clinical diagnosis (Ingram, Siegle, & Steidtmann, 2015). Questionnaires such as the Beck Depression Inventory-2 (BDI-2; Beck, Steer, & Brown, 1996), the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), or the Patient-Health-Questionnaire-2 (PHQ-2; Löwe, Kroenke, & Gräfe, 2005) are frequently utilized to assess symptoms of depression. These questionnaires assess the severity or clinical relevance of symptomatology by implementing specific cut-off scores on a scale (Ingram et al., 2015).

Studies implementing semi-structured interviews based on DSM-5 criteria for major depressive disorder reveal prevalence rates ranging from 3.6% in high-performance French athletes (Schaal et al., 2011) to 68% in Canadian Olympic swimmers (Hammond, Gialloreto, Kubas, & Davis, 2013). Reported prevalence rates of major depression vary between 3% in players of the Premier soccer league in Switzerland (Junge & Feddermann-Demont, 2016) and 19% in German athletes of various performance levels and sport disciplines (Nixdorf et al., 2013). As for mild to moderate depression symptomatology, prevalence rates between 7.6% in Swiss soccer players (Junge & Feddermann-Demont, 2016) and 33.5% in first-division collegiate athletes in the United States (Armstrong & Oomen-Early, 2009) have been described. Several studies have assessed the absence of well-being with the WHO-Five Well-Being Index (WHO-5; World Health Organization, 1998) to screen for depression. These studies documented prevalence rates of 15% in German athletes of different levels of sport performance (Spengler, Schneider, & Schröder, 2013) and 11.6% in German adolescent squad athletes (Kleinert, Sulprizio, & Anderten, 2016). In summary, there is a wide range of described prevalence rates of depressive symptomatology in the context of competitive sports. The observed discrepancies in reported prevalences may be brought about by the utilization of a variety of instruments to measure depressive symptomatology and by the implementation of various cut-off values to examine the severity or clinical relevance of symptomatology (Belz, Kleinert et al., 2018). These discrepancies might further be a result of the different characteristics of the study samples in terms of age, gender, sport discipline, and level of sport performance. The great variety in reported prevalence rates impedes the comparability of prevalence rates observed in competitive sports with those observed in the general population.

One noticeable limitation of the existing prevalence studies is the inconsistent results regarding depressive symptomatology and its association with age (Belz, Kleinert et al., 2018). To illustrate, Nixdorf et al. (2013) did not discover a link between age and depressive symptomatology, Schaal et al. (2011) reported a lower risk of major depression for underage

athletes compared to older athletes, and Kleinert et al. (2016) observed lower scores of depression in athletes aged 15 years and younger compared to older athletes. Overall, the adolescent athlete population has widely been neglected in the examination of depressive symptomatology (Belz, Kleinert et al., 2018). This pervasive disregard of adolescent athletes is surprising considering that adolescent age is assumed to represent a particularly sensitive period for the onset of depression (Andersen & Teicher, 2008). This increased risk for the etiology of depression during adolescence is explained by concurrent high stress exposure and neurological changes at this age (Andersen & Teicher, 2008). In summary, the relationship between age and depressive symptomatology remains unclear, and research on adolescent athletes is limited (Belz, Kleinert et al., 2018). Several researchers, however, have proposed that adolescent and junior athletes might be more susceptible to symptoms of depression than individuals in other age groups (e.g., Brand, Wolff, & Hoyer, 2012; Nixdorf et al., 2013). As a consequence, Brand et al. (2012) identify a need for more empirical data on adolescent athletes given that impairments to mental health at this age may contribute to severe negative consequences for the athletes' sporting career and health.

One methodological limitation of existing prevalence studies pertains to unclear definitions of the term "elite" athlete (Swann, Moran, & Piggott, 2015). Athletes defined as "elite" include first-division collegiate athletes (e.g., Armstrong & Oomen-Early, 2009; Yang, Cheng et al., 2014), professionals in their respective sports (e.g., Gouttebarge, Frings-Dresen, & Sluiter, 2015; Junge & Feddermann-Demont, 2016), athletes who previously competed at the Olympics (e.g., Kotnik, Tusak, Topic, & Leskosek, 2012), or student-athletes of elite schools (Brand et al., 2012). Due to the considerable confusion and inconsistency when defining the "elite" status in sport psychology research (Swann et al., 2015), the term "competitive" athlete is used throughout this dissertation to refer to athletes on a "continuum of eliteness" (Swann et al., 2015, p. 10), ranging from athletes competing at the regional and university level to athletes competing at the international level or in a professional league. The different definitions of the "elite" status in the body of literature impede the comparability of reported prevalence rates in relation to the level of sport performance (Belz, Kleinert et al., 2018). In addition, few studies have actually assessed the association between depressive symptomatology and level of sport performance, and these few studies have reported contradictory results. To illustrate, both a positive (e.g., Hammond et al., 2013) and a negative relationship (e.g., Junge & Feddermann-Demont, 2016) between symptoms of depression and sport performance level have been

documented. To conclude, the association between the level of sport performance and depressive symptomatology remains unclear (Belz, Kleinert et al., 2018).

Further methodological limitations of existing studies concern the size and representativeness of study samples with regard to particular countries' competitive athlete populations (Belz, Kleinert et al., 2018). Whereas Schaal et al. (2011) investigated a comprehensive sample of 2,067 of France's competitive athletes from 36 sport disciplines, other studies included fewer than 100 of their respective countries' competitive athletes, representing only one specific sport discipline (e.g., Hammond et al., 2013; Proctor & Boan-Lenzo, 2010). Furthermore, the German researchers Frank et al. (2015) criticize the deficient knowledge on the pervasiveness of depressive symptomatology in competitive sports in Germany.

In summary, an overview of depression prevalence studies among competitive athletes reveals that reported prevalences vary greatly. Moreover, existing studies present contradictory results regarding the association between depressive symptomatology and the demographic variables age and level of sport performance (Belz, Kleinert et al., 2018). Only a few studies have investigated depressive symptomatology in the adolescent age group, despite the fact that adolescence represents a vulnerable timeframe for the onset of depression (Andersen & Teicher, 2008). The published prevalence studies are often characterized by small sample sizes and a limited number of represented sport disciplines. Finally, a lack of research on depressive symptomatology among German competitive athletes has been criticized (Frank et al., 2015). With the intention of addressing the aforementioned limitations of and research gaps in prior studies, the aim of study I of this dissertation is the investigation of the prevalence of depressive symptoms in a comprehensive sample of German competitive athletes from a broad range of sport disciplines. A special focus is placed on the examination of the association between the demographic variables age and level of sport performance and the prevalence of depressive symptoms. The sample includes adolescent athletes, and the risk for depression is considered separately for four different age groups.

1.1.2 Stress in competitive sports

The competitive sport context is an extremely demanding and potentially stressful environment for athletes (Nixdorf et al., 2013; Rumbold, Fletcher, & Daniels, 2012). In the stress literature, stress is approached in three different ways: (1) stress as a response, (2) stress as a stimulus, and (3) stress as a transaction (Nixdorf et al., 2013). In the investigation of stress sources (i.e.,

"stressors") in competitive sports, researchers commonly adopt the perspective of stress as a stimulus. To illustrate, Nixdorf et al. (2015) identified three types of sport-specific stressors in German competitive sports: double burden, sport-specific demands (physiological and psychological), and conditions. The category *double burden* comprises stressors arising from conflicting interests and responsibilities beyond being an athlete (e.g., attending school or university) along with the sporting career. *Sport-specific demands* comprise physiological sources of stress, including a high training load and injuries, and psychological sources of stress such as performance expectations. The category *condition* represents stressors related to unfavorable structures in the respective sport, such as finances or lack of support within the team. Other scholars have postulated the presence of competitive stressors (Mellalieu, Neil, Hanton, & Fletcher, 2009) and organizational stressors in competitive sports (Hanton, Fletcher, & Coughlan, 2005). Competitive stressors are stressors directly related to sport performance and include inadequate preparation (i.e., mental, physical, technical, and tactical preparation), injury, external expectations, self-presentation, and rivalry/opponents (Mellalieu et al., 2009). Organizational stressors are defined as "the environmental demands (i.e., stimuli) associated primarily and directly with the organization within which an individual is operating" (Fletcher, Hanton, & Mellalieu, 2006, p. 329). Based on previous research on organizational stressors, Arnold and Fletcher (2012) identified 640 distinct organizational stressors. These identified organizational stressors were classified into the four categories leadership and personnel (e.g., coaches' behaviors and interactions, media), cultural and team (e.g., communication, roles), logistical and environmental (e.g., structure of training, travel), and performance and personal domains of an individual's sport participation (e.g., injuries, diet and hydration). In addition to sport-specific stressors, athletes experience universal stressors of everyday life. These universal stressors pertain to, for example, interpersonal conflicts and financial difficulties (Breslin, Shannon, Haughey, Donnelly, & Leavey, 2017).

Although all competitive athletes are confronted with a myriad of stressors, not every athlete experiences high levels of stress. How can individual differences in stress experiences be explained? When examining perceived stress in the competitive sport context, scholars commonly adopt the perspective of stress as a transaction and adhere to the principles of the transactional model of stress and coping (Lazarus & Folkman, 1984). Within this model, stress is assumed to develop through appraisals in a transactional process between the person and the environment. The model postulates that *cognitive appraisal* and *coping* processes serve as mediators in the relationship between stressful person-environment relationships and their acute

and more long-term outcomes. There are three types of cognitive appraisal: primary appraisal, secondary appraisal, and reappraisal. In *primary appraisal*, a person judges whether "he or she has anything at stake in this encounter" (Folkman, Lazarus, Gruen, & DeLongis, 1986, p. 572), meaning whether there is a potential harm or benefit to the person. A person can appraise a situation as irrelevant, benign-positive, or stressful. Three different kinds of stressful appraisal are postulated, namely challenge, harm/loss, and threat (Lazarus & Folkman, 1984), each being linked to distinct emotional reactions. In *secondary appraisal*, the person evaluates whether he or she can do anything to prevent or cope with harm, or to increase the likelihood of benefiting. In the process of secondary appraisal, various coping options are assessed, for example changing or accepting the situation. *Reappraisal* refers to a change of appraisal that can be based on new information from the environment, one's own reactions to the environment, and/or a result of cognitive coping efforts. The experience of stress is thought to be a result of a stressful primary appraisal and a secondary appraisal of ineffective coping strategies (Folkman, Lazarus, Gruen et al., 1986). The second mediator that is thought to affect stressful person-environment relationships and their respective outcomes is coping. *Coping* refers to "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (Lazarus & Folkman, 1984, p. 141). Coping is postulated to have two major functions: to alter the problem causing distress (*problem-focused coping*), and to handle the emotional distress that is associated with the situation (*emotion-focused coping*; Lazarus & Folkman, 1984). Problem-focused coping strategies include interpersonal efforts to change situations and problem-solving, whereas emotion-focused coping refers to strategies such as accepting responsibility and positive reappraisal. According to the findings of several previous investigations (e.g., Folkman & Lazarus, 1980, 1985), people utilize both forms of coping in almost all stressful encounters (Folkman, Lazarus, Gruen et al., 1986).

A stress response – being determined by individual appraisal and coping processes – is thought to manifest on the social, psychological, and somatic levels. Lazarus and Folkman (1984) refer to these stress responses as "adaptational outcomes" and postulate three basic areas in which outcomes of stressful encounters occur: (1) social functioning, (2) somatic health, and (3) morale and life quality (Lazarus, DeLongis, Folkman, & Gruen, 1985; Lazarus & Folkman, 1984). First, *social functioning* is defined as the effectiveness with which the demands of a specific situation are managed. Effective coping in a stressful encounter depends on a fit between "secondary appraisal of coping options and actual coping demands, and between a

selected coping strategy and other personal agendas" (Lazarus & Folkman, 1984, p. 223). Second, *somatic health* characterizes physiological changes that are generated by a stressful encounter. Third, *morale and life quality* refer to the positive and negative affect an individual experiences during and after a stressful encounter. The experienced positive and negative affect reflects the individual's current evaluation of his or her well-being based on the dimensions satisfaction/dissatisfaction, happiness/unhappiness, or hope/fear (Lazarus et al., 1985; Lazarus & Folkman, 1984). Each of these three major adaptational outcomes can also be viewed over the long term. Social functioning over the long term, for example, describes the satisfaction of an individual with interpersonal relationships or the fulfillment of his or her various roles. Somatic health relates to how an individual's way of coping with everyday life situations impacts his or her somatic health. In particular, different styles of coping are related to specific health outcomes, and it is believed that coping can affect somatic health (e.g., through the alteration of neurochemical stress responses or by hindering adaptive health-related behaviors; Lazarus & Folkman, 1984; Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986). Finally, morale and life quality, over the long term, describe how an individual feels about him- or herself and his or her conditions of life. Depression is thought to represent a long-term state of dissatisfaction or low morale (Lazarus et al., 1985; Lazarus & Folkman, 1984). Furthermore, coping is postulated to have a great impact on the association between stressful events and depression (Folkman, Lazarus, Dunkel-Schetter et al., 1986). The relationship between the three adaptational outcomes is thought to be complex, and good functioning in one area may be associated with poor functioning in another and vice versa (Lazarus & Folkman, 1984).

Scholars assume that adolescence might be an especially sensitive period for the experience of high stress levels in competitive sports (Gerber et al., 2018). Providing empirical support for this assumption, Brand et al. (2012) reported pronounced stress levels in school-aged competitive athletes. Similar findings were put forward by Richartz and Sallen (2017), who documented that adolescent athletes were more stressed than adolescent non-athletes, and that elite student-athletes even exhibited alarmingly high stress rates. Elevated stress levels during adolescence are hypothesized to stem from greatly increased practice and training demands in youth sports over recent decades (Frank et al., 2018), uncertainty associated with selection processes in talent development programs (Vaeyens, Lenoir, Williams, & Philippaerts, 2008), biological changes occurring during adolescence, and pressure to perform well both in sport and at school (Gerber et al., 2018; Sabato, Walch, & Caine, 2016).

When experiencing high levels of stress in competitive sports, coping strategies become increasingly important (Lazarus, 2000; Nixdorf et al., 2013). In this line of thought, Lazarus (2000) postulated that athletes need to possess and implement a wide array of coping strategies to safeguard their (mental) health during stressful times and circumstances and to be able to preserve their level of performance. Nicholls and Polman (2007) further argue that athletes are required to effectively cope with the prevailing stressors in competitive sports so that they can perform according to their abilities and be satisfied with their sporting experience. The coping strategies employed by athletes can have an influence on psychological parameters (Nicholls & Polman, 2007). For example, a systematic review has demonstrated that problem-focused coping strategies are predictors of positive affect and emotion-focused strategies are able to predict negative affect (Nicholls & Polman, 2007). Nicholls and Polman (2007) further investigated gender and age-related differences in coping and concluded that male athletes tend to use more problem-focused coping strategies, whereas female athletes utilize more emotion-focused strategies. In relation to age, the coping repertoire of adolescent athletes is thought to be smaller in scale and less flexible than that of adult athletes. Coping as a function of age, however, has scarcely been researched, and no final conclusion can be drawn in relation to age differences (Nicholls & Polman, 2007).

If stress is not coped with effectively, it can negatively impact athletes' sport performance, their physical and their mental health (Lazarus, 2000; Nicholls & Polman, 2007; Nixdorf et al., 2013). Negative stress-related outcomes observed in competitive athletes include fatigue and impaired recovery (Frank et al., 2018), back pain (Galambos et al., 2005; Heidari, Mierswa, Kleinert et al., 2016), injuries (Galambos et al., 2005), performance-decline, premature career-dropout (Schinke et al., 2018), and depression (Kuettel & Larsen, 2019).

1.1.3 Link between depression and stress in competitive sports

In the general population, the link between depression and stress has been empirically validated (e.g., D'Angelo & Wierzbicki, 2003; Hammen et al., 2009; Monroe & Reid, 2009). In the context of competitive sports, empirical evidence also suggests that depressive symptomatology and aspects of the stress process are closely linked. For example, Nixdorf et al. (2013) reported a positive relation between chronic stress and depressive symptomatology among German competitive athletes. The same study was able to show that the primary use of negative coping strategies such as resignation or self-pity was linked to increased symptoms of depression, whereas the primary use of positive coping strategies such as positive self-instruction and

reaction control was associated with decreased depressive symptomatology (Nixdorf et al., 2013). In a later study, the same research group identified a positive association between the experience of psychological stressors (e.g., performance pressure) and physiological stressors (e.g., injuries) and depression scores among German competitive athletes (Nixdorf et al., 2015). Similar findings were reported by Gerber et al. (2018), who demonstrated a positive correlation between experienced stress and symptoms of depression in young competitive athletes, and by Francisco, Arce, Vílchez, and Vales (2016), who identified high perceived stress to be a predictor for depression in Spanish competitive athletes.

While the aforementioned transactional model (Lazarus & Folkman, 1984) offers an excellent description of the psychological mechanisms, which can lead to maladaptive coping and potentially result in the adaptational outcome depression (Folkman, Lazarus, Dunkel-Schetter et al., 1986; Lazarus & Folkman, 1984), scholars frequently adopt a broader perspective and hypothesize a multifactorial (i.e., biological, psychological, and social) cause for depression, described as the biopsychosocial perspective (e.g., Frank et al., 2015; Gouttebarge & Kerkhoffs, 2018; Reardon et al., 2019). Gouttebarge and Kerkhoffs (2018), for example, argue that the complex and dynamic interaction between these three types of factors, and not one factor in isolation, determines the course of mental health-related outcomes like depression. The biopsychosocial perspective was first introduced with the biopsychosocial model of health and disease (Engel, 1977). The biopsychosocial model postulates the interrelatedness of biological, psychological, and social factors in relation to aspects of mental health and physical disease. Several biological, social, and psychological factors are assumed to enhance the vulnerability to depressive symptomatology. Biological factors refer to, for example, genetic vulnerabilities, biochemical imbalances, injury, and pain. Psychological factors encompass maladaptive coping skills, lack of social skills, and low self-esteem. Finally, social factors include environmental demands (e.g., work and school demands), early childhood stress, family circumstances, and peer conflicts (Schotte, van den Bossche, Doncker, Claes, & Cosyns, 2006). According to the biopsychosocial model (Engel, 1977), there are also certain protective factors that can alleviate an individual's vulnerability to depression. Examples of protective factors are a supportive social network, well-developed social skills, and adopting a less stressful lifestyle (Schotte et al., 2006).

In summary, empirical evidence (e.g., Francisco et al., 2016; Gerber et al., 2018; Nixdorf et al., 2013) and the principles of the transactional model (Lazarus & Folkman, 1984) and the biopsychosocial model (Engel, 1977; Schotte et al., 2006) lend credence to the assumption that

a positive relationship exists between depression and stress in the context of competitive sports. It becomes apparent, however, that one type of factors has frequently been disregarded when exploring depression and stress in this setting, namely biological factors. Therefore, an investigation into stress and depression in connection with biological factors in competitive sports seems justified.

1.2 Depression, stress, and back pain in competitive sports

Depression and stress have only been associated with a limited number of biological factors in competitive sports, with the majority of studies focusing on overtraining syndrome or sport injuries (see reviews by Frank, Nixdorf, & Beckmann, 2013; Junge, 2000; Wolanin et al., 2015). One biological factor that has hardly received any scientific attention in relation to depression and stress in competitive athletes is back pain. In contrast, in primary health care and the occupational setting, empirical support for the relationship between depression, stress, and back pain is extensive, as indicated by several systematic reviews (e.g., Linton, 2000; Pincus, Burton, Vogel, & Field, 2002; Ramond et al., 2011). In short, these systematic reviews revealed that depressed mood increases the risk for back pain (Linton, 2000), that stress and depressive symptoms are significant predictors of back pain (Pincus et al., 2002), and that depressive symptoms can forecast time required to recover from back pain (Ramond et al., 2011).

The pervasive scientific disregard towards the relationship between depression, stress, and back pain in competitive sports is surprising considering that back pain has emerged as a frequent problem for athletes (Belz, Heidari et al., 2018), independent of performance level or sports discipline (Heidari, Hasenbring, Kleinert, & Kellmann, 2017). Moreover, back pain in competitive sports has been associated with debilitating consequences such as performance decline, impaired quality of life, and disability (Bono, 2004; Mortazavi, Zebardast, & Mirzashahi, 2015). In a systematic review on the prevalence of back pain in competitive sports, Trompeter, Fett, and Platen (2017) reported a point prevalence of 24% and deduced that back pain is a widespread issue amongst competitive athletes.

Although physical activity plays an important role in the prevention of back pain, too much physical activity is thought to be “a possible risk factor” (Trompeter et al., 2017, p. 1184) for back pain etiology. The high volume and intensity of trainings and competitions in competitive sports exposes athletes’ bodies to immense mechanical strain and high levels of stress on their musculoskeletal system. These strains and stressors, as well as physically challenging and

sometimes uncontrollable movements (e.g., tackles, body checks), can negatively affect athletes' lower backs and can, in turn, lead to acute back pain (Foss, Holme, & Bahr, 2012; Heidari, Mierswa, Kleinert et al., 2016). Depending on the sport discipline, the mechanical strain and high stress on the musculoskeletal system are pronounced during adolescence, placing the adolescent age group at a particular risk for back pain (Allen & Hopkins, 2015). When acute back pain transitions to chronic back pain, this can have dramatic consequences for competitive athletes, including muscular deficits, performance decline, injury, and a decrease in life quality (Jonge & Kramer, 2014; Maffulli, Longo, Gougoulias, Loppini, & Denaro, 2010; Mortazavi et al., 2015). Eventually, back pain can cause athletes to prematurely drop out of their respective sport, terminating their main occupation and therefore their livelihood (Heidari, Mierswa, Kleinert et al., 2016; Maffulli et al., 2010).

For the examination of back pain in athletes, Puentedura and Louw (2012) propose the biopsychosocial approach (Engel, 1977) with a special focus on the psychosocial factors depression and stress. The majority of studies on back pain in competitive sports, however, have neglected the examination of depression and stress in association with back pain (Belz, Heidari et al., 2018; Heidari et al., 2017). The few studies that assessed psychosocial variables in association with back pain mostly only considered the factor stress and reported inconsistent results. For example, studies reported a positive relationship between stress and the experience of back pain (Heidari, Mierswa, Hasenbring et al., 2016; Heidari, J. et al., 2019) or could not identify an association between the two variables (Schulz, Lenz, & Büttner-Janz, 2016). Only Galambos et al. (2005) assessed the "triad" of stress, depression, and back pain and reported a positive association between depressed mood, perceived life stress, and previous experience of back pain.

In summary, back pain is a widespread issue in competitive sports and has been associated with detrimental performance and (mental) health outcomes for athletes. Moreover, adolescence seems to be a period in which athletes are particularly vulnerable to developing back pain (Allen & Hopkins, 2015). Scholars encourage the examination of psychosocial variables (e.g., depression and stress) in relation to back pain in competitive sports, given that this area of research has been identified as a prominent research gap (Heidari et al., 2017; Heidari, J. et al., 2019). To close this research gap, study II of this dissertation investigates the relationship between depression, stress, and back pain parameters in German competitive athletes. The study sample, again, includes adolescent athletes and places a special emphasis on the examination of age effects in the relationship between depression, stress, and back pain.

1.3 Making a case for stress-prevention interventions for adolescent athletes

Sport psychology scholars and practitioners agree that whenever possible, knowledge derived from empirical findings and theoretical frameworks should be translated to the applied field (Harwood & Thrower, 2019; Larsen, 2017). However, how can one transfer the acquired knowledge on depression, stress, and back pain, as well as their interrelatedness, to the applied work with competitive athletes? The previously reviewed empirical findings and the introduced theoretical models substantiate the assumption that components of the stress process are associated with both depression and back pain in competitive athletes. Although many athletes are able to handle the prevalent stressors in competitive sports as well as the resultant negative stress-related outcomes, other athletes struggle and experience performance deterioration and impairments to their mental and physical health (Rumbold et al., 2012). Therefore, it might be a good starting point for the applied work with athletes to target and ideally optimize components of the stress process. This consideration is in line with the conclusion of the systematic review of stress-prevention interventions for sport performers by Rumbold et al. (2012): stress-prevention interventions for athletes should aim at reducing stressors, modifying cognitive appraisals, and optimizing coping strategies. By doing so, a successful stress-prevention intervention might facilitate athletes' experiences and performances in the sport context as well as in other areas of their lives (Rumbold et al., 2012).

The previous overview of empirical findings on depression, stress, and back pain in competitive sports leads us to believe that adolescent athletes are a suitable target group for stress-prevention interventions. To clarify, adolescence is thought to represent a sensitive period for pronounced stress levels (e.g., Brand et al., 2012; Richartz & Sallen, 2017), the manifestation of depressive symptomatology (e.g., Brand et al., 2012; Kleinert et al., 2016; Nixdorf et al., 2013), and the emergence of back pain (Allen & Hopkins, 2015). Harwood, Knight, Thrower, and Berrow (2019) supported the reasoning that adolescent athletes are an important target group for stress-prevention interventions by emphasizing that those working with athletes have the responsibility for and duty of safeguarding young athletes by promoting their well-being and health. Moreover, Henriksen, Larsen, Storm, and Ryom (2014) encouraged sport psychology consultants (SPCs) to pay "special consideration to the delivery of sport psychology services to talented young athletes" (p. 246). The authors justified this recommendation by noting that adolescent athletes are becoming an increasingly important client group for SPCs due to the

rapid professionalization of youth development programs and the resulting psychological pressure placed on the young athletes (Henriksen et al., 2014).

Up to now, few stress-prevention programs have been targeted towards the improvement of components of the stress process (e.g., cognitive appraisal, emotional responses, and coping strategies) and stress-related outcomes (e.g., well-being, depression) in competitive athletes, as became apparent in the systematic review by Rumbold et al. (2012). When considering the main tenets of the transactional model (Lazarus & Folkman, 1984) that could help prevent negative stress-related (mental) health outcomes, interventions with the aim of optimizing coping processes seem promising (Fogaca, 2019). Instead, the main goal of existing stress-prevention interventions is commonly to improve athletes' sport performance. Furthermore, little is known about the effectiveness of short-term stress-prevention programs for athletes (Rumbold et al., 2012). The implementation of short-term stress-prevention programs, however, might serve as a favorable initial introduction to sport psychology services for stakeholders in youth sports (e.g., athletes, coaches, parents). This favorable initial introduction appears suitable for youth sports, as knowledge about sport psychology in this setting is sometimes vague or even non-existent, and skepticism with regard to sport psychology services frequently prevails (Johnson, Andersson, & Fallby, 2011). A positive first introduction to and awareness and acceptance of sport psychology services might then facilitate long-term and profound stress-prevention interventions in this setting (Belz, Kleinert, & Anderten, 2020; Henriksen et al., 2014).

In summary, high experienced stress can lead to a multitude of negative stress-related outcomes in competitive athletes. As a consequence, Rumbold et al. (2012) encourage scholars to develop, execute, and evaluate stress-prevention interventions for competitive athletes. A growing body of empirical evidence indicates that adolescent athletes are at high risk of suffering from stress and negative stress-related outcomes such as depressive symptoms and back pain. Therefore, adolescent athletes seem to be a suitable target group for stress-prevention interventions, and an initial short-term approach to stress-prevention interventions seems advisable. As a result, study III of this dissertation targets the development, execution, and evaluation of a theory-based short-term stress prevention intervention for adolescent competitive athletes.

1.4 Aims of the present thesis

This dissertation explores the constructs of depression and stress and factors associated therewith in competitive sports. The transactional model (Lazarus & Folkman, 1984) and the biopsychosocial model (Engel, 1977) serve as guiding frameworks. Based on the previously discussed empirical findings and theoretical considerations, the aims for three studies that constitute this dissertation were formulated. The aim of study I is to examine the prevalence for depressive symptoms in a comprehensive sample of German competitive athletes and to explore the association between depression risk and the demographic variables age, gender, and performance level. The first aim of study II is to assess the extent of depression and stress in athletes with back pain, while again analyzing age and gender differences. The second aim of study II is to examine the relationship between depression and stress and the back pain parameters *back pain intensity* and *back pain-related disability*, respectively. Finally, the aim of study III is to develop, implement, and evaluate a theory-based stress-prevention intervention for adolescent competitive athletes targeted towards the optimization of various components of the stress process. The evaluation includes the intervention's effectiveness with regard to the development of stress, coping, and depression parameters, and the usefulness of the intervention as rated by the athletes.

2 Original research

2.1 Study I

Title:	Risk for depression and psychological well-being in German national and state team athletes – Associations with age, gender, and performance level
Authors:	Johanna Belz, Jens Kleinert, Jeannine Ohlert, Thea Rau, Marc Allroggen
Journal:	Journal of Clinical Sport Psychology
Reference:	Belz, J., Kleinert, J., Ohlert, J., Rau, T., & Allroggen, M. (2018). Risk for depression and psychological well-being in German national and state team athletes – Associations with age, gender, and performance level. *Journal of Clinical Sport Psychology*, *12*(2), 160–178. doi:10.1123/jcsp.2016-0024

Abstract:

Adolescence is a vulnerable period for the development of depression. Research on depression in athletes including adolescent athletes, however, is scarce. The purpose of the present study was to assess the risk for depression depending on the athletes' age, gender, and performance level. Data were collected from 1,799 German national and state team athletes. The PHQ-2 and the WHO-5 were administered to assess the athletes' risk for depression and current state of psychological well-being. Overall, 13% of the athletes were screened positive for depression and 10% for impaired well-being. Adolescents, females and athletes of junior national teams showed a higher risk for depression and/or lower well-being than other subgroups. The finding that adolescent athletes are more vulnerable to suffer from depressive symptoms than adult athletes mirrors finding in the general population. Screening tools for depression should be followed up by clinical expert interviews to provide an external criterion for the obtained results.

2.2 Study II

Title:	Stress and risk for depression in athletes suffering from back pain: Do age and gender matter?
Authors:	Johanna Belz, Jahan Heidari, Claudia Levenig, Monika Hasenbring, Michael Kellmann, Jens Kleinert
Journal:	European Journal of Sport Science
Reference:	Belz, J., Heidari, J., Levenig, C., Hasenbring, M., Kellmann, M., & Kleinert, J. (2018). Stress and risk for depression in athletes suffering from back pain: Do age and gender matter? *European Journal of Sport Science, 18*(7), 1029–1037. doi:10.1080/17461391.2018.1468482

Abstract:

Back pain (BP), a prominent problem for competitive athletes, is a primary reason for limitations in athletic performance and daily life restrictions. As studies on the relationship between psychological variables and BP in athletes are scarce, the aim of this study was to investigate stress and depression in competitive athletes with BP. In a cross-sectional design, data of 154 competitive athletes (51% female; age: M = 18.81 years, SD = 5.05 years) were collected, assessing Performance stress, Socio-emotional stress, Risk for depression and Psychological well-being and the two BP parameters BP Intensity and Disability. Two multiple linear regressions were conducted to predict (1) BP Intensity and (2) Disability from Performance stress, Socioemotional stress, Risk for depression and Psychological well-being. Multiple linear regressions demonstrated that Performance stress (β = .21, p = .01) was the only significant predictor of BP Intensity ($F_{1,142}$ = 6.68, p = .01, R^2 = .05), whilst Risk for depression (β = .24, p = .01) was the only significant predictor of Disability ($F_{1,142}$ = 8.46, p = .01, R^2 = .06). Neither gender nor age explained a significant amount of variance in the models. Study results showed that, as in the general population, the variables stress and depression are related to BP in competitive athletes. In particular, BP intensity was found to be associated with stress and BP-related disability was associated with depression, whereas age and gender showed no association with the BP parameters. A longitudinal investigation is warranted to determine the direction of the observed relationships.

2.3 Study III

Title:	One shot—no hit? Evaluation of a stress-prevention workshop for adolescent soccer players in a randomized controlled trial
Authors:	Johanna Belz, Jens Kleinert, Moritz Anderten
Journal:	The Sport Psychologist
Reference:	Belz, J., Kleinert, J., & Anderten, M. (2020). One shot—no hit? Evaluation of a stress-prevention workshop for adolescent soccer players in a randomized controlled trial. *The Sport Psychologist*, 1–11. doi:10.1123/tsp.2019-0106

Abstract:

Adolescent soccer players experience many stressors and negative stress-related outcomes. Short-term stress-prevention programs are frequently implemented in youth sports, although there is limited evidence of their usefulness and effectiveness. Thus, the present study evaluated the usefulness and effectiveness of a stress-prevention workshop for adolescent soccer players. Ninety-two soccer players (age: *M*= 15.5 years, *SD* = 1.43; 31.5% female) were randomly allocated to either an intervention group or an intervention control group. To evaluate effectiveness, stress, coping, and depression were assessed at baseline (t1) and 4 weeks postworkshop (t2). To investigate usefulness, the perceived quality of results was assessed at t2. No intervention effects on stress, coping, and depression emerged, but both groups exhibited high values regarding perceived quality of results. Although one workshop might not be enough to modify stress-related parameters, it may be useful for adolescent soccer players and pave the way for long-term interventions.

3 Discussion

The present dissertation is targeted towards an exploration of depression and stress and associated factors in German competitive sports. The discussion consists of four parts. Firstly, the main findings of this dissertation are discussed. As all three studies are extensively discussed within their respective publications, this general discussion addresses conclusions beyond the aspects already deliberated within the individual publications. Specifically, the main findings and contributions of the individual studies are collated and discussed in the light of current research developments. Secondly, based on the empirical findings, implications for theory and practice are inferred. Thirdly, the strengths of this dissertation are enumerated, followed by the acknowledgement of limitations that must be considered. Based on these limitations, recommendations for future research projects are provided. Finally, a conclusion regarding the overall contributions of this dissertation to the current body of knowledge on depression and stress in competitive sports is drawn.

3.1 Discussion of main research findings

3.1.1 Prevalence of depressive symptoms in German competitive sports

An overview of the current body of literature reveals that existing prevalence studies on depression are characterized by varying prevalence rates and by inconsistent findings regarding the association between depressive symptomatology and certain demographic variables (e.g., level of sport performance and age). Only the association between depressive symptomatology and gender appears consistent, with female competitive athletes seemingly being more vulnerable than males (Belz, Kleinert et al., 2018). Several of the existing prevalence studies are characterized by methodological limitations such as small sample sizes, unrepresentative study samples with regard to the country's competitive athlete population, a limited amount of represented sport disciplines, and the disregard of the adolescent athlete population. The aforementioned limitations and research gaps led to the formulation of aims for study I. The aim of study I was the investigation of the prevalence of depressive symptoms in a comprehensive sample of German competitive athletes. A special focus was placed on the examination of the association between the demographic variables age and level of sport performance and the prevalence of depressive symptoms. Study I revealed that of 1,799 German competitive athletes, 13.4% were screened positively for depression and 10.2% for impairments

in psychological well-being. Adolescent age, female gender, and junior national team status were identified as risk factors for depressive symptoms and lower well-being scores (Belz, Kleinert et al., 2018). In addition, the results of study II and study III complement the picture of depressive symptoms' prevalence rates in German competitive athletes and are therefore also consulted in the following.

In all three studies attached to this dissertation, athletes were screened for depression with the disease-oriented screening tool PHQ-2 (cut-off ≥ 3) and the health-oriented screening tool WHO-5 (cut-off ≤ 9). With the PHQ-2, prevalence rates of 13.4% (study I) and 7.1% (study II) emerged. The obtained prevalence rates in study III were 9.1% at the first point of measurement and 13.6% at the second assessment. When the observed prevalence rates are compared with other studies utilizing the same measurement, the prevalence rates of study I, study II, and study III are similar to those reported by Kleinert et al. (2016) in a sample of adolescent German competitive athletes. In comparison to studies screening for mild to moderate depression with the CES-D (cut-off ≥ 16; e.g., Gulliver, Griffiths, Mackinnon, Batterham, & Stanimirovic, 2015; Wolanin, Hong, Marks, Panchoo, & Gross, 2016; Yang et al., 2007; Yang, Schaefer et al., 2014), the observed prevalence rates of all three studies are markedly lower. However, the observed prevalence rates are comparable to those studies screening for major depression (CES-D cut-off ≥ 21; e.g., Nixdorf et al., 2013; Wolanin et al., 2016; Yang et al., 2007). The PHQ-2 has been acknowledged to be suited to screening for major depression. Indeed, the observed sensitivity for this diagnosis was 87% for adults (Löwe et al., 2005), and was only slightly weaker (74%) in an adolescent population (Richardson et al., 2010). Averaged across all three studies, every 10th (10.8%) German competitive athlete was screened positively for depression with the PHQ-2.

When screening for depression with the health-oriented WHO-5, assessing impaired psychological well-being, prevalence rates of 10.2% (study I), 9.1% (study II) and 12.5% (both points of measurement in study III) emerged. These observed prevalence rates are similar to the prevalence rate of 11.6% reported by Kleinert et al. (2016) and noticeably lower than the 15% reported by Spengler et al. (2013) in a sample of competitive and amateur athletes. Considering the average prevalence rate across all three studies, about every 10th (11%) German competitive athlete was screened positively for depression with the health-oriented screening tool WHO-5. Accordingly, very similar results were obtained with the two different screening tools.

It is noteworthy that the observed prevalence rates in study I, study II, and study III fall within a narrow range. The similarity of the prevalence rates within this dissertation contrasts with the

wide range of reported prevalence rates in the body of literature on depression and depressive symptoms in competitive sports (see reviews by Frank et al., 2015; Reardon & Factor, 2010; Rice et al., 2016; Wolanin et al., 2015). The observed prevalence of 10% derived from this dissertation seems to provide a good estimate of the distribution of depressive symptoms in German competitive athletes, as it is akin to those reported in a study of a German sample also implementing the PHQ-2 and the WHO-5 (Kleinert et al., 2016). It is of great interest to compare the identified prevalence rates in German competitive sports with those prevalent in the German general population (Frank et al., 2015), as a meta-analysis was able to demonstrate that competitive athletes and non-athletes have similar risks of suffering from depressive symptoms (Gorczynski et al., 2017). In order to equate the detected prevalence rates with those observed in the German general population, a representative German study applying a longer version of the PHQ was consulted (Bretschneider, Kuhnert, & Hapke, 2017). In 2017, a German sample of 24,016 adults between 18-65 years was screened for depression with the PHQ-8 (Kroenke et al., 2009). On a scale ranging from 0-24 points, a cut-off of ≥ 10 was implemented. In this sample, 10.1% of adults were screened positively for depression, and a gender effect emerged, with a prevalence rate of 11.6% for female and a prevalence rate of 8.6% for male adults. Comparing this publication on non-athletes with the results from this dissertation indicates a similar depression risk in both populations. This observation is in line with the aforementioned findings of the meta-analysis of Gorczynski et al. (2017) and negates the notion of Schaal et al. (2011) that being a competitive athlete might be "psychopathogenic" (p. 8) in itself. However, the protective factor physical activity, which is known to reduce depression risk in non-athletes (Biddle & Mutrie, 2008), seems to be counteracted in competitive athletes, which might be due to additional strain experienced in this setting.

One of the stated aims of this dissertation was to examine the potential demographic risk factors age, gender, and performance level. Although this aim primarily pertained to study I, all three studies of this dissertation examined gender effects in risk for depression. Study I uncovered that female competitive athletes exhibited a higher depression risk than males. This finding agrees with the bulk of prevalence studies reporting the same gender effect in competitive sports (e.g., Hammond et al., 2013; Junge & Feddermann-Demont, 2016; Schaal et al., 2011) and in the general population (refer to systematic review by Angst et al., 2002). Contrary to expectations, no gender effects emerged in study II and study III. This finding might be explained by the young age of the participants of study II (average 18 years) and study III (average 15 years). Although women are more vulnerable to depression than men, this gender difference emerges during adolescence (approximately at the age of 14; Hankin et al., 1998;

Wade, Cairney, & Pevalin, 2002). The postulated gender difference might not yet have manifested in the samples of study II and study III. A further possible explanation for the missing gender effect in study III is the imbalanced gender ratio in this sample: only one-third of the participants were female.

The three studies of this dissertation add to the small body of research investigating age effects and incorporating adolescent athletes when investigating depression risk in competitive sports. The pervasive disregard of the adolescent athlete population has been criticized in the field (e.g., Brand et al., 2012) and is therefore addressed within this dissertation. Concerning age effects, study I exposed statistically significant differences in depression risk between age subgroups employing the health-oriented screening tool WHO-5. For example, early adolescent athletes (16–18 years) exhibited a higher depression risk than late adolescent (18–20 years), early adult (21–24 years), and adult competitive athletes (25–40 years). Likewise, study III revealed an age effect with the screening-tool PHQ-2: athletes aged 16-18 years expressed a higher depression vulnerability than athletes aged 13-15 years. Study II, on the other hand, revealed significantly higher well-being scores for athletes younger than 18 years in comparison to athletes older than 18 years. However, no age differences were observed with the PHQ-2 in this study. The results of study I and study III oppose the finding of Schaal et al. (2011), who reported in a sample of French high-level athletes that young athletes (<18 years) showed lower depression prevalence rates than older athletes. These authors, however, conducted semi-structured clinical interviews based on DSM-IV criteria, impeding the comparability of these results with those of the dissertation. The results of study I and study III, however, resemble those obtained by Kleinert et al. (2016) in a sample of German adolescent competitive athletes. Kleinert et al. (2016) documented that athletes aged 15-17 years exhibited higher depression scores than younger or older age groups. In order to compare the observed prevalences of depressive symptoms in the adolescent age groups of study I and study III with those prevalent in the general population, a recent study investigating German adolescent non-athletes was consulted (Wartberg, Kriston, & Thomasius, 2018). In 2018, a German sample of 1,001 adolescents aged 12-17 years was screened for depression with a validated depression screener for teenagers (DesTeen; Allgaier, Krick, Saravo, & Schulte-Körne, 2014). On a scale ranging from 0-42 points, a cut-off of ≥ 14 was utilized to screen for depression. In total, 8.1% of the adolescent non-athletes were screened positively for depression. A gender effect emerged, with a prevalence rate of 11.6% for female and a prevalence rate of 5% for male adolescents. This study further revealed an age effect, with older adolescents being at higher risk of suffering from depressive symptoms than younger adolescents. When comparing the average prevalence

rates of depressive symptoms in German adolescent athletes of study I (PHQ-2: 13.4%; WHO-5: 14.2%), study III (PHQ-2: 11.4%; WHO-5: 12.5%) and the study by Kleinert et al. (2016; PHQ-2: 16.5%; WHO-5: 11.5%) with those of German adolescent non-athletes (Wartberg et al., 2018), the prevalence rates in the competitive athletes are markedly higher. The increased vulnerability of adolescent athletes might stem from the coinciding demands of the competitive sport and school contexts (Aquilina, 2013). It has further been suggested that adolescent athletes might struggle to achieve their age-specific developmental tasks due to additional demands from the competitive sport setting (Ohlert & Kleinert, 2014). The delayed accomplishment of developmental tasks has, in turn, been related to emotional symptomatology (Seiffge-Krenke, Kiuru, & Nurmi, 2010). There are, however, too few German prevalence studies on depressive symptoms in adolescents engaged in competitive sports to make it feasible to draw definite conclusions.

Regarding the under-investigated risk factor level of sport performance, study I revealed that athletes belonging to the junior national team (C squad) exhibited a higher depression vulnerability than national team athletes with a high chance of reaching top international performance levels (i.e., B squad), and national team athletes belonging to the world elite (A squad; Belz, Kleinert et al., 2018). This finding is similar to that obtained by Junge and Feddermann-Demont (2016), who observed that the average depression score decreased with a higher level of performance. Contrastingly, Hammond et al. (2013) uncovered that athletes who were ranked higher in terms of their sport performance were more likely to meet diagnostic criteria for major depression than athletes of a lower performance rank. The three studies, however, differ in their method of assessment: whereas in study I and the study by Junge and Feddermann-Demont (2016), self-report questionnaires were utilized to assess depressive symptoms, Hammond et al. (2013) conducted semi-structured interviews to diagnose an episode of major depression based on DSM-IV criteria. In conclusion, the results of study I suggest that junior national team athletes experience a higher depression risk than athletes of more advanced performance levels.

The aforementioned findings of this dissertation resulted in a methodological consideration regarding the screening for depression with both a disease-oriented (PHQ-2) and a health-oriented (WHO-5) screening tool. When analyzing the relationship between the scores obtained with the two screening tools, medium to large correlations emerged in the three studies of this dissertation. To illustrate, the observed correlations were r = -.57 (study I), r = -.40 (study II), and r = -.61 and r = -.56, respectively (at the two points of measurement in study III). These

correlations are, on average, higher than those reported by Kleinert et al. (2016; r = -.43), but considerably lower than in the study by Löwe et al. (2004; r = -.73). Moreover, there are several cases in which screening results of the PHQ-2 and the WHO-5 were inconsistent when implementing the chosen cut-off scores (PHQ-2 score ≥ 3; WHO-5 score ≤ 9). A close examination of the results of study I will serve as an illustration. In 7.8% of cases, the PHQ-2 screened positively for depression whereas the WHO-5 did not. Contrastingly, in 4.6% of cases the WHO-5 screened positively for depression whereas the PHQ-2 did not. Adding up these percentages, in 12.4% of cases the results of the two screening tools were inconsistent. For future research, we therefore agree with the suggestion of Kleinert et al. (2016) to assess the simultaneous occurrence of conspicuous values in both the PHQ-2 and WHO-5 to prevent missing cases and to avoid risking too many false positives.

In summary, the results of study I, study II, and study III suggest that female gender, adolescent age (16-18 years), and junior performance level appear to be core risk factors for depressive symptomatology in German athletes.

3.1.2 Depression, stress, and back pain – A "triad" of interest?

Before diving deeper into the investigation of the relationship between depression, stress, and back pain, it is pertinent to conduct a closer analysis of this dissertation's findings on the stress levels experienced by athletes. This preceding assessment of stress levels seems advisable as study II and study III belong to the minority of studies in the literature on stress in competitive sports that have assessed stress levels in competitive athletes. The majority of stress studies in competitive sports have instead focused on sources of stress and have, for example, investigated different stressor types such as competitive or organizational stressors (e.g., Hanton et al., 2005; Mellalieu et al., 2009). Furthermore, the average experienced stress levels in study II and study III differ from previously reported findings. The widespread assumption that adolescent athletes show pronounced stress levels (Brand et al., 2012; Gerber et al., 2018; Richartz & Sallen, 2017) could not be confirmed in this dissertation. Instead, the adolescent age group (younger than 18 years old) in study II expressed lower stress scores than the older age group (18 years and older). Furthermore, the adolescent sample of study III demonstrated scores in the lower half on perceived stress scales. Low to medium average stress scores can also be observed in study II, potentially accounting for the lack of age effect in stress scores within this study. These low to medium stress levels are unanticipated, as it has repeatedly been postulated that the competitive sport context is an extremely demanding and stressful environment for competitive athletes in general (Nixdorf et al., 2013; Rumbold et al., 2012) and adolescent athletes in particular (Brand

et al., 2012; Gerber et al., 2018; Richartz & Sallen, 2017). The low to medium stress scores in study II are particularly surprising given that this sample of athletes are suffering from back pain, and back pain has repeatedly been related to high stress levels (Galambos et al., 2005; Heidari, Mierswa, Hasenbring et al., 2016; Heidari, Mierswa, Kleinert et al., 2016). The transactional model (Lazarus & Folkman, 1984) offers several potential justifications for the rather low stress scores. Within the transactional model (Lazarus & Folkman, 1984), the stress experience is thought to be caused by a stressful primary appraisal and a secondary appraisal of ineffective coping strategies. Consequently, the observed low to medium stress scores might imply that (1) adolescent athletes are not confronted with as many stressors as commonly assumed, (2) adolescent athletes might not appraise these environmental demands as stressful, or (3) if adolescent athletes appraise these demands as stressful, they might perceive their available coping strategies as being effective. As the stressors and the athletes' appraisal have not been investigated within the scope of this dissertation, these considerations remain speculative and require further examination. One alternative explanation for the comparatively low stress scores might lie in the time of data assessment within the competitive season. In study II, data was gathered in January and perceived stress within the past two weeks was assessed. In study III, data was gathered between January and February and perceived stress within the past four weeks was assessed. Many sport disciplines, like soccer, take winter breaks between December and January. Therefore, we might have assessed perceived stress in a period in which no competitions or even trainings took place, potentially leading to a decrease in perceived stress. Due to this methodological consideration, the observed stress levels need to be interpreted with caution and we cannot readily conclude that adolescent athletes, contrary to expectations, might not experience particularly high stress levels. Notwithstanding, these comparably low experienced stress levels observed in the adolescent athlete population might still be enough to contribute to the emergence of depression. In fact, empirical evidence suggests that experienced stress during adolescence has greater adverse effects on mental health than if it occurred during a later age (Andersen & Teicher, 2008; Hankin et al., 1998; Wade et al., 2002). Any type of perceived stress in combination with "windows of vulnerability when brain regions might be maximally sensitive to environmental influences" (Andersen & Teicher, 2008, p. 189) might lead to the etiology of depression during adolescence.

After having discussed the unexpected findings regarding the experience of stress in the adolescent athlete population, we can proceed to analyze the investigated relationship between depression, stress, and back pain in this dissertation. The general introduction provided a condensed overview of the growing body of evidence indicating a positive relationship between

depression and stress in competitive sports (e.g., Francisco et al., 2016; Gerber et al., 2018; Nixdorf et al., 2013; Nixdorf et al., 2015). It was further discussed that back pain – which has repeatedly been connected to both depression and stress in the general population – has hardly received any scientific coverage in depression and stress research in the context of competitive sports. Notwithstanding, the investigation of psychosocial variables in connection with back pain in competitive athletes seems warranted due to the high prevalence of back pain in this population (Trompeter et al., 2017). The expected close link between depression, stress, and pain was further supported by the principles of the biopsychosocial model (Engel, 1977). Study II revealed that, similarly to research findings from non-athlete samples, depression and stress were associated with back pain parameters in a population of 154 competitive athletes reporting back pain. In particular, pain intensity could be linked to stress, and pain-related disability to depression (Belz, Heidari et al., 2018).

Study II extends previous investigations on depression and stress in competitive sports as it connects these psychosocial variables to back pain parameters and was therefore able to address a prominent research gap (Heidari et al., 2017). The observed relationship between stress and back pain intensity and depression and back pain-related disability, does not seem surprising as similar results were observed in primary health care and the occupational context (e.g., Linton, 2000; Pincus et al., 2002; Ramond et al., 2011). Up to now, only a limited number of biological factors have received scientific coverage in relation to depression and stress in competitive athletes. For example, the overtraining syndrome and injuries have predominantly been assessed as biological factors associated with depression and/or stress (e.g., Armstrong & van Heest, 2002; Junge & Feddermann-Demont, 2016; Lepine & Briley, 2004; Reardon & Factor, 2010). As the findings of study II imply, the consideration of the factor back pain in association with depression and stress is warranted because back pain appears to be a widespread problem in competitive sports with detrimental consequences for the athletes' performance, sport career, and mental and physical health (Trompeter et al., 2017).

In summary, this dissertation extends previous work on depression and stress in competitive sports by linking these variables to the previously widely disregarded biological factor of back pain. However, the causal relationship between depression, stress, and back pain is yet to be clarified, as will be discussed in more detail in the limitation section.

3.1.3 Transferring empirical and theoretical knowledge to prevention programs

Many sport psychology scholars and practitioners aspire to translate knowledge derived from empirical findings and theoretical frameworks to the applied work with competitive athletes (Harwood & Thrower, 2019; Larsen, 2017). A myriad of empirical findings supports the assumption that adolescence is a sensitive period for the experience of stress and stress-related mental and physical health outcomes (e.g., Andersen & Teicher, 2008; Brand et al., 2012; Gerber et al., 2018; Richartz & Sallen, 2017). Additionally, the preceding sections indicate that adolescent athletes are more vulnerable to developing depressive symptomatology than older age groups (study I and study III) and adolescent non-athletes (Wartberg et al., 2018). Based on the growing body of evidence indicating a close link between depression and stress in the context of competitive sports (e.g., Francisco et al., 2016; Gerber et al., 2018; Nixdorf et al., 2013; Nixdorf et al., 2015), a need for stress-prevention interventions for adolescent competitive athletes was deduced for the field of applied sport psychology. Recommendations of a systematic review on stress-prevention programs (Rumbold et al., 2012) and guiding principles of the transactional model (Lazarus & Folkman, 1984) led to the inference that preventive interventions should be targeted towards optimizing aspects of the stress process (e.g., coping strategies). Therefore, the aim of study III was to develop, implement, and evaluate a theory-based stress-prevention intervention for adolescent soccer players, targeted towards the optimization of various components of the stress process. The evaluation of the intervention pertained to the assessment of the intervention's effectiveness regarding stress, coping, and depression parameters and to the usefulness of the intervention as perceived by the athletes. No intervention effects on stress, coping, and depression parameters emerged. Notwithstanding, the athletes perceived the stress-prevention intervention to be useful, especially with regard to the improvement of their performance and well-being.

Study III considerably adds to the current body of literature on stress-prevention interventions for four reasons. Firstly, the applied intervention was targeted towards the optimization of stress coping and stress-related mental health outcomes, in contrast to most stress-prevention interventions, which have instead primarily aimed at the enhancement of sport performance (Rumbold et al., 2012). Secondly, the intervention had a short-term focus. The systematic review on stress-prevention programs in competitive sports by Rumbold et al. (2012) indicated that there are only a few short-term stress prevention interventions and no effect of the interventions' duration could be deduced. Thirdly, this stress-prevention intervention was targeted towards adolescent competitive athletes as this age group has been proposed to be

especially sensitive to negative stress-related health outcomes. This assumption receives empirical support from study I. Schaal et al. (2011) further emphasize the importance of targeting the adolescent athlete population by arguing that "psychological issues and stressors […] should be addressed early, in order to help avoid the development of a fullblown disorder and its potential consequences on the athletes' health and career" (p. 8). Hitherto, few stress-prevention interventions have been developed specifically for the adolescent athlete population (Olmedilla et al., 2019; Sallen, Hemming, & Richartz, 2018). Lastly, this intervention was evaluated both on its effectiveness regarding stress-related parameters and on its perceived usefulness. To evaluate the usefulness in addition to, or as part of, the effectiveness of a stress-prevention intervention is a novel approach in the field (Dallmann, Bach, Zipser, Thomann, & Herpertz, 2016; Sallen et al., 2018), although the American Psychological Association (APA; 2002) long ago postulated that the usefulness of an intervention is a foundation for its effectiveness.

The lack of intervention effects in study III led to a methodological consideration pertaining to the standardization of group programs. A valuable point is made by Sallen et al. (2018), who state that stress-prevention interventions should not be rigid concepts, but rather should be guideline-oriented and proven approaches that allow for flexibility with regard to the needs of the target group. The effectiveness of the stress-prevention intervention of study III might have been impeded by the rather rigid and standardized approach to the intervention. For instance, the SPCs who executed the stress-prevention interventions received a written intervention protocol to ensure the comparability of the intervention content within this randomized controlled trial (RCT). Although a certain amount of flexibility was encouraged so that the SPCs could react to the participants' input, the main content and activities of the intervention were prescribed. It is important to weigh the advantages of standardized group programs that can be empirically investigated (e.g., ensuring comparability of content, reaching many athletes at once) versus the disadvantages (e.g., not being able to tailor the intervention to the individuals' needs; Sallen et al., 2018). Despite the aforementioned reservations regarding the implementation of standardized stress-prevention group programs, the results of study III imply that this type of program is perceived to be useful by the athletes. Therefore, standardized group programs like study III's stress-prevention intervention might be important stepping-stones towards the awareness and acceptance of sport psychological services in adolescent competitive sports and might counteract the still frequently-prevailing skepticism towards sport psychological services in this setting (Johnson et al., 2011). As a result, the implementation of interventions with a long-term focus might be possible. The knowledge and strategies that were

acquired in the group setting might then be debriefed and deepened in a one-on-one setting between the SPC and an individual athlete (Dallmann et al., 2016). In these subsequent individual consultations, the SPC might then tailor the knowledge and the strategies introduced in the stress-prevention intervention to the needs of the individual athlete.

In conclusion, this dissertation was able to contribute to the prevailing knowledge on depression and stress and factors associated therewith in competitive sports. Innovative aspects of this research include the investigation of depressive symptoms of competitive athletes in Germany, a country in which existing knowledge on depression prevalence rates was deemed insufficient by researchers (Frank et al., 2015). This dissertation further includes the previously widely neglected population of adolescent athletes in the samples of all three studies. The overall results indicate that approximately every 10th German competitive athlete might experience an increased depression risk. Female athletes, adolescent athletes, and junior national team athletes show an increased depression risk. Furthermore, this dissertation was the first to link the psychosocial variables depression and stress to a prominent issue with debilitating consequences in competitive sports – back pain. Consequently, this dissertation suggests that the postulated "triad" of depression, stress, and back pain, which has long been accepted in primary health care and the occupational setting, also seems to exist in competitive sports (Belz, Heidari et al., 2018). Based on a plethora of empirical findings suggesting that adolescence is an especially vulnerable period for the experience of stress and stress-related mental and physical health impairments (Andersen & Teicher, 2008), the need for stress-prevention interventions for this age group was inferred. As a consequence, this dissertation addressed several recommendations for future stress-prevention interventions and developed, implemented, and evaluated a theory-based short-term stress prevention intervention for adolescent competitive athletes. Although no intervention effects emerged, the stress-prevention intervention was perceived to be useful by the adolescent athletes. To ensure forthcoming interventions' effectiveness with regard to stress and depression parameters, a long-term approach and additional individual consultations of the adolescent athletes are advised (Belz, Kleinert et al., 2020).

3.2 Implications for theory and practice

As described in the introductory chapter, the transactional model (Lazarus & Folkman, 1984) and the biopsychosocial model (Engel, 1977) serve as guiding frameworks for this dissertation. The transactional model (Lazarus & Folkman, 1984) offers an excellent description of

underlying psychological processes which can lead to maladaptive coping under stress and potentially result in depression (Folkman, Lazarus, Dunkel-Schetter et al., 1986; Lazarus & Folkman, 1984). Additionally, the biopsychosocial model (Engel, 1977) is consulted to offer a broader perspective regarding the etiology of stress-related mental and physical health outcomes, and to acknowledge the dynamic interaction between biological, psychological, and social factors.

Study II indicates a relationship between the psychosocial variables stress and depression and the biological variable back pain in the context of competitive sports. Due to the cross-sectional nature of study II, however, the direction of this relationship remains unclear. The experience of depressive symptoms and/or stress could represent psychosocial risk factors leading to the development of back pain. Alternatively, the experience of back pain might have served as a biological risk factor for the experience of stress and the etiology of depressive symptoms. Both directions of this relationship are possible within the biopsychosocial model (Engel, 1977). When considering the transactional model (Lazarus & Folkman, 1984), back pain might be regarded as an adverse adaptational outcome of the stress process, belonging to the category *somatic health*. Alternatively, suffering from back pain might have served as a stressor that elicited a stressful primary appraisal and a secondary appraisal of coping strategies deemed ineffective. These appraisal processes could, in turn, have led to the experience of stress and to the negative adaptational outcome depression, belonging to the postulated category *morale and life quality* (Lazarus et al., 1985; Lazarus & Folkman, 1984).

Based on the process-oriented approach of the transactional model (Lazarus & Folkman, 1984), the results of study III should be investigated more closely, as this study design was longitudinal in nature. One main aim of study III was to evaluate the stress-prevention intervention's effectiveness. The intervention's effectiveness referred to the positive development of experienced stress levels, coping strategies, risk for depression, and psychological well-being. According to the transactional model (Lazarus & Folkman, 1984), improved coping strategies would be expected to be associated with favorable developments of experienced stress and the adaptational outcomes depression risk and well-being. Unfortunately, the coping strategies of the athletes did not improve subsequently to the stress-prevention intervention. Furthermore, and in line with the transactional model (Lazarus & Folkman, 1984), there were also no significant positive developments in stress levels, depression risk, and well-being four weeks after the intervention. According to the principles of the transactional model (Lazarus & Folkman, 1984), one might hypothesize that a successful intervention needs to alter coping

strategies in order to effectively reduce stress and depression risk and improve well-being. It is therefore of great interest to consider how an intervention could be structured in order to enhance the athletes' coping strategies. Several recommendations were provided in the last section, such as taking a long-term approach to stress-prevention interventions for adolescent athletes or following up the content of the intervention with individual consultations between a SPC and an athlete. Further recommendations for future stress-prevention interventions, based on a novel theoretical framework, are deliberated in the following paragraphs.

Although the transactional model (Lazarus & Folkman, 1984) and the biopsychosocial model (Engel, 1977) have made valuable contributions to stress and depression research in competitive sports, neither model was developed for the specific context of competitive sports. If we knew more about the psychological predictors for depression in competitive sports, prevention could become more "athlete-specific, effective and economical" (Nixdorf, Beckmann, & Nixdorf, 2020, p. 1). With this thought in mind, a promising novel theoretical model to explain depression etiology in the setting of competitive sports was proposed just a few months ago by Nixdorf et al. (2020). This model is called the sport-specific diathesis-stress model and represents a shared "temporal, stress-related process model" (Nixdorf et al., 2020, p. 1) regarding the development of burnout and depression in athletes. Within this framework, depression is thought to develop from the two unfavorable personal factors (1) dysfunctional attitude (i.e., perfectionism and dependency) and (2) the negative coping strategy of resignation ("diathesis"), which interact with the severe stressor lack of recovery ("stress"). The sport-specific diathesis-stress model (Nixdorf et al., 2020) was developed based on longitudinal data on junior competitive athletes throughout one sporting season with the aim of identifying predictors for both depression and burnout. The postulated predictors were a result of hierarchical multiple linear regression analysis for best model fit (Nixdorf et al., 2020). This novel model is promising for the advancement of the knowledge of this dissertation insofar as it was developed considering data from adolescent competitive sports and identified underlying mechanisms for depressive symptom etiology. An important ambition of the model is to use the knowledge on underlying mechanisms to promote prevention for athlete populations (Nixdorf et al., 2020). The two postulated vulnerabilities for depression, dysfunctional attitudes and resignation as a negative coping strategy, and the assumed severe stressor, lack of recovery, should firstly be confirmed in future prospective studies. In case the hypothesized underlying mechanisms for the etiology of depression can be replicated, this model would offer an excellent starting point for the genesis of forthcoming prevention programs for adolescent competitive athletes.

The stress-prevention intervention that was developed within study III can be analyzed with regard to the sport-specific diathesis-stress model (Nixdorf et al., 2020). Although the postulated personal vulnerability of dysfunctional attitudes was not addressed within the stress-prevention intervention, the optimization of coping strategies was a main intervention goal. However, the adverse coping strategy of resignation was not specifically focused on within the intervention. Notwithstanding, the postulated stressor lack of recovery, which is assumed to interact with the personal vulnerabilities of the athletes, received some attention within the intervention of study III. To illustrate, the athletes were taught a brief version of the relaxation strategy Progressive Muscle Relaxation (PMR) by Jacobson (1929). This part, however, only accounted for one third of the content of the intervention. If the hypothesized personal vulnerabilities and the stressor can be replicated in future studies, the emphasis of forthcoming preventive interventions could be placed on the promotion of recovery strategies and the reduction of the negative coping strategy resignation. Some questions, however, remain unanswered: Which type of recovery should be targeted? Recovery is thought to be multifaceted and includes psychological, physiological, and social aspects (Kellmann & Kallus, 2001). Consequently, future research would need to clarify which type of recovery serves as a stressor when it is lacking. It would further be necessary to elaborate upon how athletes could learn to avoid employing the adverse coping strategy of resignation. It can be hoped that the authors of the sport-specific diathesis-stress model (Nixdorf et al., 2020) will provide specific recommendations on how to transfer the postulated principles of the model to the preventive work with athletes in forthcoming publications.

A number of practical implications can be derived from this dissertation. The first implication for practice pertains to the screening for depressive symptoms in competitive sports. Study I, study II, and study III disclosed that approximately every 10th German competitive athlete expressed elevated depressive symptoms and/or impaired well-being. Furthermore, study I and study III identified adolescent athletes aged 16-18 years as experiencing a higher depression risk than younger or older age groups. A practical implication derived from these findings is the establishment of a screening for depressive symptoms in competitive sports as part of regular sport-medical check-ups during adolescence. If a screening uncovers conspicuous results, treatment options should be made available to the athlete. The screening for depressive symptoms and the provision of treatment options for adolescent competitive athletes has already been implemented in North Rhine-Westphalia (Belz, Kleinert et al., 2018; Kleinert et al., 2016). Adolescent state and national team athletes in North Rhine-Westphalia participate in a standardized depression screening as part of their annual medical check-up. If the screening

reveals signs of depressive symptomatology, *MentalEmpowerment*, a German initiative targeted towards the maintenance and promotion of mental health in high-performance sports in Germany, informs the underage athlete and a legal guardian about a potential depression risk. Concurrently, the athlete is offered alternative ways of dealing with the positive screening result, for example by consulting a sport psychologist or by being referred to a sport psychiatrist (Belz, Kleinert et al., 2018; Kleinert et al., 2016). If a standardized state-wide screening for adolescent athletes cannot be implemented in other states in Germany, another consideration would be to include a screening for depression in short-term stress prevention workshops, as described in study III (Belz, Kleinert et al., 2020). If athletes are screened in the context of their sport organization and in a group setting, the fear of the stigma of seeking help, which is frequently prevalent in competitive sports (Henriksen et al., 2019), would also be circumvented. In case of positive screening results, the at-risk athletes could receive further preventive workshops in smaller groups, tailored to their needs.

A second practical implication addresses the need to increase mental health awareness in general, and awareness of depressive symptomatology in particular, in the context of competitive sports (Kleinert et al., 2016; Nixdorf et al., 2020). Specifically, SPCs, psychotherapists, or sport psychiatrists could educate the "athletic care network" (Wolanin et al., 2015, p. 60), including coaches, trainers, and the medical team, about depression prevalence rates in competitive sports (Heidari, J., Pelka, M., Beckmann, J., & Kellmann, 2019; Wolanin et al., 2015). These individuals should be taught to identify signs and symptoms of depressive symptomatology among athletes and to offer appropriate referrals if deemed necessary. Wolanin et al. (2015) emphasize that the education of the athletic care network is "key to the optimal evaluation, management, and outcome of depression in athletes" (p. 60). In their consensus statement concerning the improvement of mental health in competitive sports, Henriksen et al. (2019) even go one step further and advocate the addition of a "mental health officer" to the athlete support staff of sport organizations. The role of a mental health officer would be "to manage, monitor, and evaluate a structure to support athlete mental health" (Henriksen et al., 2019, p. 6). Among others, the tasks of a mental health officer would include the education of key stakeholders (e.g., coaches, athletes, medical staff) to increase mental health literacy, building and maintaining a network of service providers and a system of referral, and screening for athlete vulnerability and organizational risk factors (Henriksen et al., 2019). While the addition of a mental health officer to the athlete support staff of sport organization might still be a distant dream rather than a short-term reality, the establishment of such a

position in sport organizations is to be desired in order to ensure the presence of a certified and experienced professional with the mental health of the athletes as their primary focus.

3.3 Strengths, limitations, and future directions

This dissertation is characterized by several strengths. The first strength pertains to the comprehensive size and exceptional characteristics of the sample of study I. While many previous studies on depression prevalence rates have included less than 200 athletes of their country's competitive athletes (e.g., Gouttebarge et al., 2015; Hammond et al., 2013; Proctor & Boan-Lenzo, 2010), study I was able to acquire 1,799 German competitive athletes as participants. This above-average size of the study sample is only exceeded by a French sample of 2,067 athletes (Schaal et al., 2011). Furthermore, study I was able to include athletes of 128 sport disciplines, representing 93 of 107 non-handicapped sports as well as 35 of 43 handicapped sports in Germany (Belz, Kleinert et al., 2018). In comparison, the study by Schaal et al. (2011) only included 36 sport disciplines, and various studies in the field solely investigated athletes of one sport discipline (e.g., Gouttebarge et al., 2015; Hammond et al., 2013; Prinz, Dvorak, & Junge, 2016). To the authors' knowledge, study I herewith investigated the highest number of represented sport disciplines in a prevalence study on depressive symptomatology in competitive sports. The sample of study I was further characterized by the inclusion of both female and male athletes and by a balanced gender ratio. Several studies in the field only incorporated either male *or* female athletes (e.g., Gouttebarge et al., 2015; Prinz et al., 2016; Proctor & Boan-Lenzo, 2010) or the samples were characterized by imbalanced gender ratios (e.g., Schaal et al., 2011; Yang et al., 2007). Based on the comprehensive sample size, the broad spectrum of represented sport disciplines, and the balanced gender ratio, the results of study I are assumed to be an accurate estimate of the prevalence rates of depression in German competitive sports.

A further strength of this dissertation concerns the study design of study III. In order to evaluate the effectiveness and usefulness of a stress-prevention intervention for adolescent soccer players, an RCT was implemented. RCTs are considered the gold standard in clinical practice since they provide the best approach to minimize the influence of confounding variables and therefore enable definite conclusions on the treatment's effect (Bothwell, Greene, Podolsky, & Jones, 2016). As a consequence, this study design is suggested for experimental studies of psychological interventions with athletes (Martin, Vause, & Schwartzman, 2005). The random allocation to an intervention and an (intervention) control group is difficult to realize in the

naturalistic setting of sport organizations or youth development programs and could therefore not be realized in similar intervention studies (e.g., Olmedilla et al., 2019; Sallen et al., 2018).

The third strength of this dissertation addresses the consideration of two widely neglected populations in research on depression and stress in competitive sports: the adolescent population in study I, study II, and study III, and athletes impaired by back pain in study II. Firstly, the adolescent competitive athlete population has been widely disregarded in the context of mental health in competitive sports (Belz, Kleinert et al., 2018; Brand et al., 2012). However, their integration seems of paramount importance because adolescence is thought to represent a particularly sensitive period for the etiology of depression (Andersen & Teicher, 2008). The integration of adolescent athletes into the samples of the three studies was associated with additional efforts for the acquisition of participants and data collection: in addition to the adolescents' consent for study participation, the consent of a legal guardian of underage athletes had to be obtained. This often led to delays in data assessment or – in case of missing consent of either one of the parties – to the exclusion of certain athletes. Based on the aforementioned considerations, the inclusion of adolescent athletes is perceived to be a considerable strength of this dissertation. Athletes suffering from back pain represent a further widely neglected athlete population in the field. While several studies have focused on stress and/or depressive symptoms in injured athletes (e.g., Brewer & Petrie, 1995; Prinz et al., 2016), athletes suffering from back pain have solely been integrated into study samples of injured athletes and have received the same label (e.g., Galambos et al., 2005). As it has been acknowledged that back pain is a prominent issue in competitive sports with detrimental mental and physical health outcomes (Heidari et al., 2017; Heidari, J. et al., 2019; Trompeter et al., 2017), the investigation of this specific athlete population in study II is considered to be a noteworthy strength of this dissertation.

While it is important to point out the strengths of this dissertation project, it is equally imperative to critically discuss its limitations and the inferred suggestions for future research endeavors. The first limitation is within the cross-sectional design of study I and study II. The implementation of cross-sectional designs and the assessment of demographic variables along with depressive symptomatology are common in the field (e.g., Gulliver et al., 2015; Schaal et al., 2011; Wolanin et al., 2016). While these studies have been acknowledged to progress the current state of the art in the field, researchers have criticized this type of study design as providing little information on developmental factors and underlying mechanisms regarding the etiology of depressive symptomatology (Frank et al., 2015; Nixdorf et al., 2020). To enable

researchers to draw causal inferences and gain knowledge for the development of prevention programs, determinants and mechanisms of depressive symptomatology should be investigated by means of longitudinal study designs. Despite the aforementioned disadvantages of cross-sectional study designs in research on depression, study I served an important purpose in that it was able to provide valuable knowledge about depressive symptom prevalence rates in German competitive athletes, thus covering a prominent and previously criticized research gap (Frank et al., 2015). The cross-sectional study design of study II also bears several complications. Although the results of study II suggest a connection between depression, stress, and back pain parameters, the design of the study prevents causal inference. An extension of the design to a prospective approach would therefore be advised for forthcoming research. Nonetheless, study II is intended to serve as a pilot study regarding the investigation of the potential "triad" of depression, stress, and back pain in competitive athletes.

The second limitation of this dissertation project lies within the results' small effect sizes. In study I, for example, highly significant differences between subgroups of the demographic variables (i.e., age, gender) emerged. The effect sizes for these group differences were, however, only small. Furthermore, the regression models that were identified in study II only accounted for 5% (back pain intensity) and 6% (back pain-related disability) of variance. Both results indicate that other predictors explain a large share of variance in depression or back pain, respectively. Concerning depression, the presence of an injury or the overtraining syndrome (Wolanin et al., 2015), high levels of chronic stress or negative stress-recovery states (Nixdorf et al., 2013; Nixdorf et al., 2020) might have explained more variance in depression scores. With regard to back pain parameters, the respective sport discipline, the training volume, or the body-mass index of the athlete might have accounted for more variance in the regression models (Trompeter et al., 2017). The additional assessment of the aforementioned variables in relation to depression and back pain might be of interest for upcoming studies.

The third limitation lies within the exclusive assessment of depressive symptoms via screening tools in this dissertation. In their consensus statement, Henriksen et al. (2019) voice several points of criticism regarding the utilization of screening tools to detect mental health impairments in competitive sports. Firstly, the authors object that prevalent scales tend to measure mental illness rather than mental health. This criticism does not pertain to studies I, II, and III, as all three studies screened for depression with a disease-oriented (PHQ-2) *and* with a health-oriented screening tool (WHO-5). Researchers suggest implementing both types of screening tools in order to screen not only for mental illness (i.e., depression) but also for the absence of mental illness (i.e., well-

being). A joint use of both screening tools is thought to provide added diagnostic value (Kleinert et al., 2016). A further critique point relates to the observation that many screening tools are "decontextualized rather than adapted to specific sport and/or socio-cultural contexts" (Henriksen et al., 2019, p. 4). One might argue that in studies I, II, and III, a sport-specific tool could have been chosen instead of the sport-unspecific screening tools PHQ-2 and WHO-5. The consensus statement of the IOC on athlete mental health (Reardon et al., 2019), for example, suggests the sport-specific Baron Depression Screener for Athletes with ten items (Baron, Reardon, & Baron, 2013). Despite not being sport-specific, the PHQ-2 and WHO-5 were implemented due to their brevity (two items and five items, respectively) and practicability in the sport context. A further reason for the choice of measurement was to make it possible to compare the findings of this dissertation with those of other prevalence studies having implemented the same tools in competitive sports (e.g., Kleinert et al., 2016; Spengler et al., 2013) and in non-athletes (e.g., Allgaier et al., 2012; Christensen, Haugen, Sirpal, & Haavet, 2015; Richardson et al., 2010). The fact that the PHQ-2 and WHO-5 are frequently employed both in athlete and non-athlete populations also invalidates the criticism of Reardon et al. (2019), who state that different instruments are frequently used in athletes compared with the general population. A final critique point is that screening tools typically only measure symptoms and not underlying issues and mechanisms (Henriksen et al., 2019; Nixdorf et al., 2013). To address this issue, the screening results should be validated by additionally employing clinical intake interviews or observations. While this suggestion is generally agreed with, the size of the respective study samples (1,799 participants in study I, 154 participants in study II, and 92 participants in study III) made it impossible to offer additional clinical intake interviews for all participating athletes. However, after having finalized their data assessment, participants of all three studies received the contact details of and were encouraged to contact *MentalEmpowerment* if they experienced symptoms of depression or impaired psychological well-being. In case athletes contacted the initiative, a short informal intake interview was conducted to estimate a potential risk for depression. If a risk for depression was assumed, the athletes in question were directly referred to psychotherapists and psychiatrists for a formal clinical intake interview. Although the use of screening tools in studies I, II, and III was not automatically followed up by clinical interviews to validate the screening results, the participating athletes were still able to benefit from clinical intake interviews if deemed necessary.

The fourth limitation concerns the exclusive use of self-report measurements for the assessment of depressive symptoms and back pain. Firstly, pertaining to the assessment of back pain in study II, self-reports appear to be the gold standard of pain assessment due to their

practicability, comprehensibility, and scientific evaluation in terms of psychometric properties (i.e., reliability, validity; Breivik et al., 2008). Nevertheless, the integration of behavioral (e.g., range of motion) or physiological markers is suggested to reduce bias in pain reporting and to enable a multidimensional assessment of back pain (Breivik et al., 2008). Secondly, pertaining to the assessment of depressive symptomatology, the application of self-report measures is useful in assessing the presence or severity of depressive symptoms. These measurements are not able, however, to diagnose clinical depression, to assess the degree of impairment, or to rule out conditions with similar symptoms (e.g., burnout or the overtraining syndrome; Ingram et al., 2015). Future studies should contemplate conducting investigations on clinical populations (with regard to both diagnosed back pain and major depressive disorder) to confirm the obtained results within this dissertation.

3.4 Conclusions

This dissertation began to close the criticized research gap pertaining to the insufficient knowledge on depressive symptoms prevalence rates in German competitive sports (Frank et al., 2015). The results of study I, study II, and study III suggest that German female athletes, adolescent athletes aged 16-18 years, and junior national team athletes appear to be more vulnerable to depressive symptoms than other athlete populations. Based on the average prevalence rate across all three studies, about every 10^{th} German competitive athlete was screened positively for depression. Comparing this average prevalence rate with that reported in a representative sample of non-athletes (Bretschneider et al., 2017), a similar depression risk in both populations can be inferred. Within study II of this dissertation, the psychosocial variables depression and stress were linked to back pain, a prevalent issue with debilitating consequences in competitive sports (Trompeter et al., 2017). In particular, pain intensity was found to be related to stress, and pain-related disability was linked to depression. This dissertation was the first to investigate this potential "triad" in the context of competitive sports. The knowledge of empirical evidence and theoretical frameworks gained within this dissertation was then transferred to the field of applied sport psychology and a stress-prevention intervention for adolescent athletes was developed, implemented, and evaluated in study III. Although no intervention effects on stress, coping, and depression parameters emerged, the adolescent athletes still perceived the preventive intervention to be useful, especially with regard to the improvement of their performance and well-being. In a nutshell, this dissertation was able to provide new insights into depression, stress, and factors associated therewith in

competitive sports by means of basic research via cross-sectional designs (study I and study II) and a longitudinal preventive intervention study (study III). Notwithstanding, many aspects remain to be closer illuminated, and prospective studies should consider investigating the mechanisms of stress and stress-related conditions such as depression in competitive sports to improve the understanding of their etiology and to be able to deduce effective preventive interventions for competitive athletes. As for practical implications, more emphasis should be placed on the prevention of pronounced stress and stress-related (mental) health disorders in adolescent competitive sports. Preventive actions might consist of standardized screening for depressive symptomatology during adolescence, the provision of preventive interventions for at-risk athletes, and the establishment of a mental health officer or a similar role in sport organizations. If these suggestions are implemented, perhaps tragic cases like that of Robert Enke, who took his own life after years of battling with depression, can be prevented in the future.

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