Fakultät für Sport- und Gesundheitswissenschaften
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Depression and burnout in (junior) elite athletes: Reviewing the state of knowledge and analysing their relationship

Dipl.-Psych. Univ. Raphael Nixdorf

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Content

1 Psychological disorders in elite sports

Athletes are expected to be tough, aggressive dominant and successful in competition as well as in most other aspects of their lives. In short, athletes are considered to have a clear masculine gender role identity, which is a dominant perception even in female athletes (Lantz & Schroeder, 1999). According to the narrow attributes of being tough, aggressive and getting things done athletes can function as role models for young sport spectators (Biskup & Pfister, 1999). And even to athletes themselves the athletic identity is very specific and goes along with global recognition as well as having a sport lifestyle and the bodily dimension of elite sport (Stephan & Brewer, 2007). Therefore, media reports about athletes failing to fulfil this narrow role image, or even being psychologically disordered, are sometimes received with surprise or shock. However, these reports of a mismatch between image and reality are increasingly common and supported by the scientific evidence.

For example, a recent qualitative analysis by Doherty, Hannigan, and Campbell (2016) revealed that depressed athletes are under extensive pressure to maintain a certain image. The authors argue that, in an athlete's view, depression represents the antithesis of what would be accepted in sport. Elite sports require personal and psychological characteristics such as goal-setting, self-direction, prioritizing sport over other activities, dealing with setbacks, unshakable confidence, superior concentration skills, and pushing through pain (e.g. MacNamara, Button, & Collins, 2010), whereas psychological problems such as depression appear certainly less suitable. In their interviews one participant pointed out: "I can't tell my sponsors that this is happening because I could be a liability to them, does suicidal represent your brand?" (Doherty et al., 2016, p. 6). Their report represents the image of clinically relevant psychological problems, such as depression, in elite sports. Obviously, an open discussion and the promotion of understanding in regards to psychological problems and disorders would be helpful and heighten the chance for adequate support for suffering athletes.

However, a common strategy in elite sports is to ignore the apparent problem; clinically relevant problems in athletes are still underrepresented in sport-psychological research and practice. This research is mostly concerned with performance enhancement, such as mental or cognitive training or interventions in order to optimize motivational aspects allowing even meta-analyses in this field cover the effectiveness of sport psychological interventions on performance (D. J. Brown & Fletcher, 2017). A traditional definition of

sport psychology is concerned only with psychological factors that influence participation and performance in sport and exercise, while well-being was only recognized by the Division of Exercise and Sport Psychology (Division 47) of the American Psychological Association after the millennium (Gardner & Moore, 2006). However, the impact of depression or burnout on performance may be considerably higher than previously estimated: not only is sport withdrawal part of the syndrome, but in the worst case suicide might occur. Thus, even under a perspective of performance enhancement and without speaking of the ethical importance of the promotion of athletes' mental health, clinical psychology should be a considerable part of sport psychology.

Taking a closer look at clinical sport psychology, we find so little research on mental health and well-being that narrative overviews were able to describe almost each study on mental health problems in athletes (e.g. Hoyer & Kleinert, 2010). Thus, reliable sources and estimates of the prevalence of depression in athletes are scarce. Therefore, the importance of scientific research on this matter appears to be highly needed. Consequently, the present dissertation aims to enhance the scientific knowledge on depression and burnout among elite and junior elite athletes. More specifically, this dissertation addresses the current state of knowledge of depression in a systematic manner and analyses the relationship between the constructs of depression and burnout.

1.1 Depression in elite sports

Depression is commonly recognized as a psychological disorder and the concept of depression is deeply rooted in medical history. Therefore, several types of depression are included in the current fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM V, American Psychiatric Association, 2013). Depressive syndromes are characterized by symptoms of depressed mood, anhedonia, fatigue, feelings of guilt and suicidal ideation. Furthermore, depression can be regarded as a multisystem disorder with affective, cognitive and physiological manifestations (Insel & Charney, 2003; Lee, Jeong, Kwak, & Park, 2010). In addition to its symptoms and consequent increased risk of suicidal behaviour (Hawton, Casanas, Haw, & Saunders, 2013), depression is a severe psychological disorder which can manifest itself in a long-lasting chronic problem associated with other comorbidities (Holzel, Harter, Reese, & Kriston, 2011).

Current data on prevalence of depression among the German general population suggest that about 8.1% of those aged 18 to 79 years suffer from depressive symptoms (Jacobi et al., 2014). The prevalence of unipolar depression in the German population is estimated to be 7.7% in a 12-month time period, the 12-month prevalence is 6% for major depression and 2% for dysthymia. Altogether, about 6.2 million Germans have a unipolar depression in a period of 12 months (Jacobi et al., 2014). The national and international risk of developing a depression during life (lifetime prevalence) is estimated to be 16-20% (Bijl, Ravelli, & van Zessen, 1998; Ebmeier, Donaghey, & Steele, 2006).

In elite sports, there is little research on depressive syndromes with few studies among US collegiate athletes to be found (e.g. S. Armstrong & Oomen-Early, 2009; Yang et al., 2007). Other theoretical work points out the overlap with other syndromes in sports such as the overtraining syndrome (L. E. Armstrong & Van Heest, 2002; Puffer & McShane, 1992), which develops out of a long-lasting imbalance between training and recovery. Especially after long periods of intensified training, performance can decrease. If this state persists after a resting period of at least several weeks or months, it is referred to as overtraining syndrome (Meeusen et al., 2013). Besides the decline in performance, which is obviously negative for athletes, this chronic state can manifest itself in symptoms such as fatigue, loss of weight and appetite, sleep disturbances, emotional instability, anxiety, heavy transpiration, heavy muscles and frequent, small infections (Budgett et al., 2000). Also the connection between increased training loads and negative or depressed mood has been established in previous empirical work (Morgan, Brown, Raglin, O'Connor, & Ellickson, 1987; Morgan, Costill, Flynn, Raglin, & O'Connor, 1988; O'Connor, Morgan, Raglin, Barksdale, & Kalin, 1989; Raglin, Morgan, & O'Connor, 1991). Thus a further examination of depression and overtraining might be useful. However, to argue – without clinical evidence -- that depression may occur in athletes but "the most common syndrome seen in the competitive athlete is the chronic fatigue/depression syndrome" (p. 329; Puffer & McShane, 1992), might contribute to minimizing the potential risk of depression in elite athletes and therefore research on this matter.

Focusing on empirical evidence, in German athletes there was however no clear data on prevalence or general mechanisms of depression until recently. Thus knowledge on possible mechanisms were rather speculative. Therefore Nixdorf, Frank, Hautzinger, and Beckmann (2013) addressed this issue in a first cross-sectional study aiming to gain information on depression prevalence in German elite athletes. In a sample of $N = 162$ athletes ($n = 99$ elite level, $n = 35$ junior level, $n = 29$ amateur level), depressive

syndromes were assessed using the *Allgemeine Depressionsskala* (ADS; Hautzinger, Bailer, Hofmeister, & Keller, 2011), which is the German version of the Centre of Epidemiology Scale – Depression (CES-D; Radloff, 1977). Based on a cut-off score of 23, around 15 % of the elite athletes were positively identified as having depressive symptoms and therefore at high risk of being diagnosed with a depressive disorder. This prevalence appears to be relatively high for this high-functioning sample, although perhaps typical for the general population based on the used measurement. In addition, depressive symptoms had high to moderate associations with risk factors such as chronic stress, current state of stress and recovery, and various coping strategies such as resignation, flight, or positive self-instruction (Nixdorf et al., 2013).

This study highlighted the need for further investigation of depression in German elite athletes. However, to gain a more precise picture the integration of various information is needed. There is plenty of research on depressive disorders in the general population available. However, the important question is, can this information be used in the context of elite sports? Therefore, the current state of empirical research in regards to depression in elite athletes needs to be summarized and compared to the available general findings. This would reveal the relevance of this topic to elite sports, discover opportunities to apply knowledge from the general population to the specific population of athletes, and point to missing information which future research might address.

1.2 Burnout in elite sports

Burnout is mainly described as a three-dimensional syndrome in response to occupational stress, involving emotional exhaustion, cynicism and lack of professional efficacy (Maslach & Jackson, 1981; Maslach, Schaufeli, & Leiter, 2001). Research on burnout in elite sports started in 1984 (Caccese & Mayerberg, 1984) and was followed by many studies, as is illustrated by the 5 reviews conducted so far (Dale & Weinberg, 1990; Eklund & DeFreese, 2015; Fender, 1989; Goodger, Gorely, Lavallee, & Harwood, 2007; Gustafsson, DeFreese, & Madigan, 2017). In addition, the concept of burnout was adapted to the domain of sports and called *athlete burnout* (Smith, 1986). Athlete burnout is characterized by three core dimensions (see also table 1), which are a) physical and emotional exhaustion, b) sport devaluation and c) reduced sense of accomplishment (Raedeke & Smith, 2001).

The construct of burnout was conceptualized in different ways in the context of sports (Gustafsson et al., 2017). Smith (1986) proposed a cognitive-affective stress model and therefore saw athlete burnout primarily based on personal factors such as personality and motivational factors which are influencing a stress-based process. Later, Coakley (1992) focused on the social aspects athletes are exposed to, such as conditions, structures and environments. He argued that athletes experience a lack of control over their sport participation and this promotes a unidimensional athletic identity. This in turn would elevate the risk for burnout. Other approaches emphasized the risks due to sport commitment (Raedeke, 1997) or negative motivational states (amotivation, extrinsic motivation) according to the self-determination theory (Li, Wang, Pyun, & Kee, 2013; Ryan & Deci, 2000). More recently, Gustafsson, Kenttä, and Hassmén (2011) suggested an integrated burnout model which includes many of the antecedents (perceived sport stress, unidimensional athletic identity, less adaptive forms of sport motivation, etc.).

Ample empirical research has been conducted to gain information on athlete burnout (for review see Eklund & DeFreese, 2015). For example, perfectionism is often discussed as a predecessor to athlete burnout (Gustafsson et al., 2017). Perfectionism can be described as a personal disposition characterized by striving for flawlessness and setting exceedingly high standards. It is accompanied by tendencies towards overly critical evaluations of one's behaviour (see Flett & Hewitt, 2002; Frost, Marten, Lahart, & Rosenblate, 1990; Hewitt & Flett, 1991b). The concept of a multidimensional personality disposition (Enns & Cox, 2002) has different aspects. Some aspects are regarded as maladaptive and other aspects as adaptive (Stoeber & Otto, 2006). Especially in athletes, research is concerned with the discussion about adaptive and maladaptive perfectionism (Gotwals, Stoeber, Dunn, & Stoll, 2012). Therefore, perfectionistic concerns have been related to athlete burnout (e.g. Hill, 2013; Hill, Hall, Appleton, & Kozub, 2008) and longitudinal studies support the connection between perfectionistic concerns and athlete burnout (Madigan, Stoeber, & Passfield, 2015, 2016).

Also, other psychological and sociological factors are being discussed in regards to athlete burnout. Social support has been shown to be negatively associated with athlete burnout (Coakley, 1992; DeFreese & Smith, 2013). Coping with stress was shown to be related, and also might mediate the burnout-perfectionism association (Hill, Hall, & Appleton, 2010; Raedeke & Smith, 2004). Further, motivation has been demonstrated to play an important role and autonomous motivation might therefore reduce athlete burnout (Adie, Duda, & Ntoumanis, 2008; Appleton & Hill, 2012; Jowett, Hill, Hall, &

Curran, 2013). More specific, a recent longitudinal study revealed that autonomous motivation may partially mediate the relationship between perfectionistic concerns and athlete burnout (Madigan et al., 2016). Taken together, there is an active discussion an athlete burnout with many useful information regarding mechanisms and important factors associated with burnout.

Table 1

Comparison of symptoms of depression and athlete burnout

Depressive symptoms (according DSM V, American Psychiatric Association, 2013)	Athlete burnout core symptoms (according Raedeke & Smith, 2001)
– *Fatigue or loss of energy* – Change in weight – Insomnia or hypersomnia – Psychomotor agitation or retardation	– *Physical and emotional exhaustion*
– *Depressed mood* – Feelings of worthlessness and/or guilt – Impaired concentration or decision making	– *Reduced sense of accomplishment*
– *Anhedonia (loss of interest and pleasure)* – Suicidal ideation	– *Sport devaluation*

Note. Symptoms set in italics represent major criteria for each construct. This table was modified and included with the kind permission from Frank, R, Nixdorf, I., & Beckmann, J. (in press). Analyzing the Relationship Between Burnout and Depression in Junior Elite Athletes. *Journal of Clinical Sport Psychology*.

1.3 Depression and burnout in elite sports

In contrast to depression, there are no prevalence rates reported for athlete burnout. This is mainly due to the lack of a generally-accepted definition of presence or absence of a burnout syndrome. Also in terms of clinically recognized diagnostic systems, such as the DSM V (American Psychiatric Association, 2013) or the current International Classification of Diseases (ICD 10; World Health Organization, 2012), burnout is not represented as a formal main diagnosis. In fact, the missing definition of burnout has been a major critique over the past decades (Bianchi, Schonfeld, & Laurent, 2015). And

still, burnout is often considered as a part or a sub-category of depression (for review see Bianchi et al., 2015). The question arises as to whether burnout and depression are separable into distinct entities (Schonfeld & Bianchi, 2016).

Cresswell and Eklund (2006) argued that they are two different constructs and their theoretical distinction needs empirical clarification. However, relatively little evidence is gathered on this matter, even in the general population (Bianchi et al., 2015). The results of these studies indicate that the constructs share elements but essentially address different phenomena (Bakker et al., 2000; Toker & Biron, 2012). Due to the struggles in defining burnout, the common strategy of discriminating both constructs is by analysing their main measurements. On this theme, confirmatory factor analyses support the distinct assumption between burnout and depression in the general population (Bakker et al., 2000; Toker & Biron, 2012), as well as in elite athletes (De Francisco, Arce, Vílchez, & Vales, 2016). The present research follows the assumption of two different constructs, and addresses how they are related and connected. Both constructs can be related on a symptom level, on a conceptual level and regarding their relation over time. These issues will be addressed in the following pages.

1.3.1 Relation of syndromes

By their common definitions, athlete burnout and depression have some overlapping symptoms (table 1). Physical and emotional exhaustion can be expected to overlap with fatigue or loss of energy, for example. Depression has more detailed physiological symptoms, such as change in weight, sleep disturbances or psychomotor changes, than burnout: however, such disturbances can be expected in physically and emotionally exhausted persons, since functions of the hypothalamic–pituitary–adrenal axis (HPA axis) are likely to be affected after chronic stress or fatigue (Lee et al., 2010; Varghese & Brown, 2001). The second core symptom of burnout is reduced sense of accomplishment. Here, the relation to the occupational domain (sport) is apparent. Besides this relationship, reduced sense of accomplishment can be reflected as the cognitive impairment and negative thinking, which is also well known for depressed patients (Beck, 2005; Haffel et al., 2005). Recent research has demonstrated for burnout to be connected to such depressive cognitive styles (Bianchi & Schonfeld, 2016). The third core symptom -- sport devaluation -- appears to be linked with anhedonia, which can be described as the reduction of joy in important aspects of life. Obviously, sport can be expected to be highly important for athletes.

Summing up the comparison, there appears to be a large overlap in symptoms of both concepts. However, it is notable that depression offers a much more detailed description of main diagnostic criteria. Also, depression has clear symptoms on the cognitive and somatic level (e.g. change in weight, psychomotor agitation, impaired concentration), while burnout does not in this precise manner. This might be due to the struggles in defining burnout and its rather broad and vague core symptoms. At the same time, this difference offers some degree of differentiation: in regards to burnout negative thoughts and affected psycho-physiological symptoms are only concerned with sports and the exhaustion resulting from it. In contrast, depressive symptoms are not bound to a specific personal domain, and are expected to affect most aspects of a person's life and identity.

1.3.2 Relation of concepts and factors

The already highlighted conceptual perspectives of burnout and depression might relate both constructs. More specifically, they both appear in a stress-based perspective and might be linked in this regard. Taking a closer look at their conceptual definition regarding stress, burnout is defined as being connected to occupational stress (Maslach et al., 2001), which is also highlighted in the core dimensions for athletes (Raedeke & Smith, 2001). This could be regarded as a potential difference between burnout and depression and would lead to the question of whether depression in athletes is mainly linked to their sport or to other aspects of their lives. Recent research in elite athletes illustrated connections between depression and sport-related factors including injuries (Kerr, Marshall, Harding, & Guskiewicz, 2012; Mainwaring, Hutchison, Bisschop, Comper, & Richards, 2010), overtraining (L. E. Armstrong & Van Heest, 2002), failure during competition (Hammond, Gialloreto, Kubas, & Davis, 2013) or effects of the sport discipline (Nixdorf, Frank, & Beckmann, 2016; Schaal et al., 2011; Wolanin, Hong, Marks, Panchoo, & Gross, 2016). Furthermore, an exploratory analysis of major stressors revealed higher depression scores for athletes, with stressors mainly related to their sport and the demands within (Nixdorf, Frank, & Beckmann, 2015). These findings raise doubt on the potential to differentiate burnout from depression by the connection to athletes' occupation. However, there might be cases of depressive episodes in athletes which are due to factors unrelated to sports or triggers located outside of sports (e.g. genetics, life events).

When focusing on important, associated factors for burnout and depression connections are also apparent. As already pointed out, perfectionism is regarded as an important factor in the development of athlete burnout (Gustafsson et al., 2017; Madigan et al.,

2016). Further, perfectionism seems to be especially important in sports, where exceedingly high standards might be desired in order to perform at the best personal level. Thus adaptive and maladaptive aspects should be considered in this domain (Gotwals et al., 2012). However, the concept of perfectionism is well known in regards to depression; and research highlights the potential impact of perfectionistic attitudes (Cox & Enns, 2003; Hewitt & Flett, 1991a, 1993; Hewitt, Flett, & Ediger, 1996). In fact, there is a long history of research on dysfunctional cognition and attitudes in clinical patients (e.g. Beck, 1967; Weissman & Beck, 1978). Perfectionistic thinking is therefore considered an important part of dysfunctional attitudes (Beevers, Strong, Meyer, Pilkonis, & Miller, 2007; de Graaf, Roelofs, & Huibers, 2009) and later efforts examined the relation between perfectionistic thinking and dysfunctional attitudes (Ashby & Rice, 2002). Therefore, research showed that specific attitudes and beliefs (such as distorted or negative thinking, overgeneralized assumptions, or selective information processing) are apparent in depressed patients, and assumed that such dysfunctional attitudes illustrated a vulnerability for clinical disorders, certainly depression (Beck, 2005; G. P. Brown & Beck, 2002).

Unfortunately, this connection is missing in elite athletes: instead research is more concerned with the syndrome of burnout. Recent research indicated connections between burnout and dysfunctional attitudes in the general population (Bianchi & Schonfeld, 2016). Thus, perfectionism and dysfunctional attitudes might be highly relevant for athletes and might bare information for the relation of both constructs. Again, research is needed in order to unravel this potentially valuable information.

1.4 Research potential

As already highlighted there are multiple challenges and possibilities in regards to research on depression and burnout in athletes. First, research on depression is scant in elite athletes. Especially when thinking of the possible negative implications and severity of this clinical disorder (Hawton et al., 2013; Holzel et al., 2011) a thorough investigation seems appropriate. Thus, a clear picture of the current state of knowledge would be useful in regards to estimating the relevance of this topic and also to direct future research.

Second, many questions arise regarding the relationship between depression and burnout. These questions address the distinctiveness of both constructs, their overlap and relationship in regards to their symptoms, their connection in regards to their conceptual

frameworks and therefore important factors and mechanisms they might share, and how they are related temporally and thus how they possibly affect each other. Much research has been done on burnout in elite athletes, which might be useful in regards to depression. Knowledge could be transferred, and prevention could be based on shared important factors and thus be more effective. Furthermore it might be valuable to know which construct precedes the other or is more sensitive so screening for athletes' mental health could be more specific. However, knowledge of the relation between burnout and depression is certainly needed in order to approach these advantages.

1.5 Aim of the studies

The following studies were conducted in order to target two main goals: 1) Review the state of knowledge on depression in elite athletes and 2) Relate the constructs of depression and burnout. More specifically, the review of depression should provide an overview of studies covering this topic and highlighting prevalence rates in the various samples, to approach an evaluation of the relevance of depression in athletes. Furthermore, knowledge on associated factors should be summarized and information provided regarding important research questions and study designs.

The relation between burnout and depression offers a wide range of questions that can be investigated. The present study focuses on the question of if depression and burnout are related regarding their symptomatology in junior elite athletes. On a conceptual level the question of whether stress is a shared, critical aspect for both constructs should be approached. Finally, the temporal relation regarding a potential predecessor should be addressed.

2 Methods

The present dissertation implements different research approaches and methods. In the first article the goal was to provide a useful overview on prevalence rates and psychological factors in regards to depression. This was executed by a systematic review, which should provide guidance for further research. The second study was conducted in order to relate depression and burnout among junior elite athletes. This was addressed in a cross-sectional and longitudinal study design, which revealed useful clues in regards to their conceptual and temporal relation. The study was part of a funded research project, described in the following.

2.1 Study 1: Systematic literature review

The review on depression in elite athletes was conducted to provide an overview of the subject and to highlight research potential for further investigations on this matter. In order to ensure a systematic approach we conducted the review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Liberati et al., 2009). As some studies on depressive symptoms among collegiate athletes addressed the difference between athletes and non-athletes, this question was considered in the present review. However, there were only a few studies and they varied in their approaches to comparison, so no further examination (e.g. systematic comparison, meta-analysis) of this question could be performed. Instead, the results (observed prevalence rates of depression in athletes) were critically discussed and related to findings in the general population. Of further interest were associated factors which provided information into possible comorbidities and important factors to depression in athletes. We highlighted and discussed these factors in regard to overall findings.

2.2 Research project

From 2014 till 2016 the *Bundesinstitut für Sportwissenschaft* (BISp) founded a project in order to promote prevention of depression and burnout in junior elite athletes. The project was initiated, applied for, planned and executed by my colleague Insa Nixdorf and myself. The project was conducted to cover multiple research questions, with the main goal being to investigate mechanisms of depression and burnout in junior elite athletes in order to gain knowledge of risk factors and ideas for prevention. The present study on the relation between burnout and depression covered one of the questions of

interest. The project developed from previous results on the relevance of clinical psychological issues among junior elite athletes, and followed also the recommendations supposed by the review in study 1.

In this project we focused on junior athletes for several different reasons. First of all, prevalence of depression was surprisingly high in German junior elite athletes (Nixdorf et al., 2013). Therefore, this group might be at a special risk which should be accounted for in this research. More generally, the onset of depressive syndromes starts to develop in early adolescents with its main peak around 31 years of age (Jacobi, Wittchen, et al., 2004). Recent findings in the German *Bundesgesunheitssurvey* studies suggest an even earlier onset (Jacobi, Klose, & Wittchen, 2004) and further evidence points out that initial depressive episodes occur mainly in early adolescence and during puberty (Birmaher et al., 1996; Hankin et al., 1998). In addition, previous research in junior athletes has identified certain stressors due to multiple adjustments during this stage of an athletic career, such as transitions into other surroundings, which can be colleges or other training groups (Beckmann, Szymanski, Elbe, & Ehrlenspiel, 2006; Yang et al., 2007). Finally, the project's goal was to develop prevention strategies for applied practice in young athletes. For all these reasons we prioritized young athletes.

2.3 Study 2: Relating burnout and depression

To analyse the mechanisms between depression and burnout in junior elite athletes, we used several different designs and analyses. The present study treated burnout as a different construct from depression, which is in line with recent research results (Bakker et al., 2000; Cresswell & Eklund, 2006; Toker & Biron, 2012). To assess the two constructs, we used the ADS (Hautzinger et al., 2011) for depression and the Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001; Ziemainz, Abu-Omar, Raedeke, & Krause, 2004) for burnout. Both questionnaires are frequently used and validated in adults and are also implemented in junior athletes (e.g. Appleton & Hill, 2012; Hill, 2013; Nixdorf et al., 2016).

A first analysis was conducted in order to relate depression and burnout cross-sectionally and investigate their relationships with stress. Thus chronic stress and current state of recovery were assessed to cover different aspects of stress. In a multiple linear regression, each construct was regressed against the other, with chronic stress and recovery as predictors. This provided insight into their current relation in regards to stress. This will

enrich the conceptual discussion with results which either support or oppose the stress-based assumptions, which in turn could possibly explain the syndromes' overlap. At first glance this appears similar to a mediational pattern, where a mediator (stress, in this case) accounts for a connection between two variables. However, for a mediation process the causal location of the mediator has to be between the dependent and independent variable (Hayes, 2013) while stress is most certainly not causally located between burnout and depression. Instead, the interest is the interrelation of all constructs. Therefore, we applied the multiple linear regression in order to cover this research question.

For the temporal link between depression and burnout, we performed a cross-lagged panel model (CLPM) analysis. Three waves in the longitudinal design were conducted in order to cover important different phases of sporting season. These phases were the preparatory phase, the competition phase and the recovery phase after the season's most important competition. As discussed by Rogosa (1980) the CLPM is a convenient approach to test temporal links between constructs. It is however also argued, that other approaches might be superior (Hamaker, Kuiper, & Grasman, 2015). The analysis of longitudinal data therefore depends on the study being conducted and the research question (Selig & Preacher, 2009). In this case, we were interested in inter-individual change regarding the constructs, which was best captured by the CLPM.

In the present study we also considered the use of latent change models as well as the use of latent growth curve models, since a change over the season in the dependent variable could be expected (for discussion of the models see Selig & Preacher, 2009). However, although theoretically plausible, our focus in this study was not on the intra-individual change and its effect on the other construct, but rather the temporal relation of depression to burnout which is again best captured with the CLPM. From a statistical perspective, both latent-modelling approaches would require a higher sample size as more parameters would have to be estimated. Thus they were not chosen in the present analysis.

Another possible analysis method considered was the implementation of random intercept – cross lagged panel models (RI-CLPM). This modelling approach includes a random intercept in order to account for stable, trait-like individual differences. It is an attempt to disentangle the within-person process from stable between-person differences and thus account for possible errors or bias in the data (Hamaker et al., 2015). Thus we calculated RI-CLPM models additionally. However, due to the low sample size and the inclusion of additional, latent factors to the model, power was too low to get any useful

results for interpretation. However, the RI-CLPM model gave similar results to the CLPM model in the current study, which supports the analyses and results we present.

3 Studies

3.1 Study 1: Depression among elite athletes

Title:	Depression among elite athletes: Prevalence and psychological factors
Authors:	Raphael Frank, Insa Nixdorf & Jürgen Beckmann
Publication:	(2013) *Deutsche Zeitschrift für Sportmedizin*, *64*(11), 320-326. Doi: 10.5960/dzsm.2013.088

The present study was carried out after the first investigation of depression prevalence rates and associated factors in German elite athletes (Nixdorf et al., 2013). This first examination illustrated the relevance of depressive syndromes for German athletes. In order to deliver a systematic overview over prevalence rates and important factors, we conducted this systematic review. The goal was to critically discuss the prevalence rates in the various studies and highlight potential aspects for future research.

The initial literature research revealed only a few articles. This allowed a more descriptive approach to the findings, since statistical approaches (e.g. comparison of effect sizes) could not be performed. Therefore, our main focus for the presentation of the findings was a discussion of the substantial differences in observed prevalence rates and the discussion of possible important other factors.

As the first author, I mainly conducted, planned, executed and wrote the present study and the paper. Substantial support from the other authors was welcomingly appreciated.

The manuscript was accepted by the *Deutsche Zeitschrift für Sportmedizin* in 2013. The German version of the article is attached at the end of this dissertation. As the first author, I translated the following English version, which was published in 2015 by the *Deutsche Zeitschrift für Sportmedizin*. Indication via title, keywords and abstract is in German and English language. Thus, both versions are openly accessible and indicated by international research databases. The included article is printed with the kind permission of the authors and the journal *Deutsche Zeitschrift für Sportmedizin*.

Frank R, Nixdorf I, Beckmann J

REVIEW

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Depression among Elite Athletes: Prevalence and Psychological Factors

Depressionen im Hochleistungssport: Prävalenzen und psychologische Einflüsse

1. TECHNISCHE UNIVERSITÄT, *München*

Summary

› **Depression** among elite athletes has raised public awareness. Interestingly, empirical data on the issue are rare. Neither representative prevalence rates nor insights into the special mechanisms leading to depressionin the field of elite athletes are known in detail. The following work reviews the current state of research trying to get a first summary in what is known about underlying mechanisms leading to depression and trying to answer the question whether or not depression are widespread among German elite athletes.

› **By analyzing current studies** in this field, the present article provides a scientific overview of first findings and academic voids. Initial studies on German elite athletes point out that the prevalence for depressive symptomatology in elite athletes is comparable to the general German population. Due to the small number and quality of studies there are no representative data. Therefore, future studies using clinical criteria of assessing depressive episodes are needed.

› **Associated factors in competitive sports** are high levels of chronic stress, coping strategies, and the balance of physical and psychological stress and recovery. Therefore, the sport specific physical stress seems to play an important role. There are uncertain hints for social factors, such as team cohesion, and individual factors (e.g. perfectionism). However, there are insufficient studies to draw statements about relevance or effect of these topics. Further studies could gain scientific evidence by examining the causality and theory driven hypotheses of these factors.

Zusammenfassung

› **Depressionen** im deutschen Hochleistungssport stehen immer mehr im Fokus des öffentlichen und medialen Interesses. Interessanterweise sind aber nur wenige empirische Daten über die Thematik vorhanden. Weder repräsentative Prävalenzraten noch zugrundliegende Entstehungsmechanismen dieser Krankheit in einer Population von Hochleistungssportlern sind empirisch abgesichert. Die folgende Übersichtsarbeit fasst den aktuellen wissenschaftlichen Stand zusammen, versucht erste Einblicke in mögliche Zusammenhangsfaktoren zu bieten und widmet sich der Frage, ob Depressionen im deutschen Hochleistungssport besonders vertreten sind.

› **Eine Auswertung der aktuellen Studien** zu diesem Thema soll erste Erkenntnisse sowie Forschungslücken kritisch darstellen. Erste Untersuchungen im deutschsprachigen Raum deuten darauf hin, dass depressive Symptomatik im Spitzensport mindestens so ausgeprägt ist wie in der deutschen Bevölkerung. Aufgrund der immer noch zu geringen Anzahl und Qualität an Studien lassen sich allerdings keine empirisch gesicherten Zahlen finden. Hierfür fehlen repräsentative Studien mit klinischen Beurteilungskriterien.

› **Als für den Sport relevante Faktoren** haben sich bisher chronischer Stress, Stressverarbeitungsstrategien und die Balance zwischen Erholung und Belastung aufdecken lassen. Dabei scheint auch die sportspezifische körperliche Belastung eine wesentliche Rolle zu spielen. Auch lassen sich vage Hinweise auf soziale Faktoren, wie etwa der Mannschaftszusammenhalt und individuelle Faktoren (z.B. Perfektionismus) finden. Die Studienlage ist hier allerdings noch zu gering, um Aussagen über Relevanz und Wirkung dieser Themen treffen zu können. Weitere Forschung könnte vor allem durch die Untersuchung von Faktoren im Hinblick auf kausale und theoriegeleitete Hypothesen einen Mehrwert darstellen.

KEY WORDS
Depression, elite athletes, prevalence, stress, coping, recovery

SCHLÜSSELWÖRTER
Depression, Hochleistungssport, Verbreitung, Stress, Coping, Erholung

Introduction

Media reports on athletes suffering from psychological disorders have recently become more frequent. In the past, this topic had been largely excluded if not tabooed. Accordingly, clinical sport psychological approaches are scarce. Health in elite athletes seems to be mainly considered in terms of proper physical functioning. Incidences of athletes with psychological disorders are rarely recognized and often stigmatized (36). If prevalences are examined at all, diverse assumptions on determinants are given. On the one hand it is argued, that athletes are highly vulnerable for developing depressive symptoms due to their outstanding position in society, and the tremendous pressure and level of stress they experience. On the other hand the position is found that athletes are especially resilient and therefore are less vulne- ›

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CORRESPONDING ADRESS:
Dipl.-Psych. Raphael Frank
Technische Universität München
Georg-Brauchle-Ring 60/62
80992 München
✉: raphael.frank@tum.de

Table 1

Overview of the included studies concerning their sample, methods, results of prevalence and assessed factors related to depression. POMS (Profile of Mood States); CES-D (Center for Epidemiologic Studies Depression Scale, 32); ADS (Allgemeine Depressionsskala, 14); PAI (Personality Assessment Inventory, 25). *labeled studies were added subsequently and have not been identified by data base research. The studies were ordered by quality of assessment of depression.

DEPRESSION ASSESSMENT	SAMPLE OF ATHLETES	DESIGN	PREVALENCE, ROUNDED	ASSESSED FACTORS RELATED TO DEPRESSION	STUDY
Interview by experts	N=2067 Representative sample in France sport discipilnes unknown	cross-sectional design for assessment of prevalence	last 6 months: 4% life-time: 11%	differences across sport disciplines and gender further clinical disorders	Schaal et al., 2011
ADS	N=162 (99 profess.; 35 youth)	cross sectional; correlational online study	professionals: 15%	chronic stress,	Nixdorf et al., in press*
Cut-off=23	German athletes 18 sport disciplines		youths: 20%	coping, exhaustion & recovery	
CES-D **Cut-off=16**	N=257 College, USA 13 Sport-teams	cross sectional; correlational study	21% (Cut-off=23: 6%)	state und trait anxiety „freshman"	Yang et al., 2007
	N=66 College, USA Baseball player	cross-sectional; comparison athletes vs. Non-athletes	16%	coping	Proctor & Boan-Lenzo, 2010
	N=104 (Athleten) College, USA sport discipilnes unknown	cross sectional; correlational study	33.5%	self-worth, social connectedness, sleep	Armstrong & Oomen-Early, 2009
PAI **Cut-off=32**	N=105 (athletes) College, USA soccer, volley-, basket- and football, tennis, swimming	cross-sectional; comparison athletes vs. Non-athletes	female 10% male 4%	social anxiety, probblems with alcohol, perceived social support differences between gender	Storch et al., 2005
single questions on "melanchonly, depression, unhappyness"	N=723 German athletes Handball, athletics	cross-sectional	2-4% (several times a week)		Thiel et al., 2010*
self-rating on categories „honestly yes", „honestly no", „no answer"	N=1154 German athletes sport discipilnes unknown	cross-sectional; online assessment, Randomised Response Technique	9%		Breuer & Hallmann, 2013*
positive testing on antidepressants	N=82880 50 nations 178 sport disciplines	cross-sectional and longitudinal	1%		Machnik et al., 2009

rable. Hoyer and Kleinert (19) provide a first, general overview of different views on psychological disorders in competitive sports and the importance of the topic. The following article is specifically focusing on the topic of depression and provides a summary of empirical data regarding this syndrome. Research on prevalence rates and possible factors in the development of depression in elite athletes, as well as gaps in research, are discussed critically.

Methods

For reviewing the current research data the following databases were searched: PubMed, MEDLINE, PsycINFO, PSYNDEX and The Cochrane Library. Terms for the searching process were: depression & athlete(s), depressive mood & athlete(s), depressive symptoms & athlete(s) and depression & sport(s) (same terms were entered in German, too). No article was excluded due to publication date. Studies meeting the following selection criteria were included: Empirical study, sample with elite athletes and assessing depression as a dependent variable. Six studies meeting the criteria were identified (see tab. 1). Afterwards, references were searched for further articles, which might not be found through original database search. Three additional articles were included, which met the above mentioned criteria. Table 1 provides an overview of all included studies. Articles assessing only reactive depressive syndromes due to injuries were excluded. Articles on the topic burnout were not included due to the insufficient definition and therefore its unknown relation to depressive syndromes.

For illustrating the reported prevalences, articles were first searched accordingly. Secondly, the included articles were searched for further assessed factors. The following review is structured accordingly. The mentioned prevalence rates are structured through the origin of the assessed sample, whereas the factors were grouped by their topic.

Prevalence of depressive symptoms

Epidemiologic data from the general German population

Depressive disorders are widespread in the German general population. The lifetime prevalence is reported to be 17% (42, 20). The 12-month prevalence is 11% and the 4-week prevalence is 6% (20). Women are more prone with a lifetime prevalence of 25% than men with a prevalence of 12%.

International research in competitive sports

Most articles regarding depressive symptomatology in elite athletes origin from US Colleges. Yang et al. (43) surveyed 257 athletes reporting a prevalence of 21% for depressive syndromes in this sample. It is noteworthy, that this study employed the CES-D, a validated and widespread questionnaire for assessment of depressive syndromes.

Yang et al. (43) rated scores above 16 points as an indication of depression. This relatively low cut-off might contribute to the comparatively high prevalence rate in their study.

Armstrong and Oomen-Early (2) reported a prevalence of 33.5%, using the same cut-off. In this study athletes were reported with significant lower levels of depressive symptoms compared to non-athletes. Procotor and Boan-Lenzo (29) used the same cut-off. They report lower rates of prevalence in athletes than in non-athletes, too.

Further studies, for example Storch, Storch, Killiany and Roberti (38) who compared athletes with non-athletes, could not find empirical support for this difference. In their study a general, clinical instrument for assessment (PAI, 25) was used with a conservative cut-off of 32 points. The prevalence rate was rather low and athletes did not differ significantly from non-athletes regarding depressive symptoms. In this sample, athlete's prevalence was between 10% (females) and 4% (males).

Summarizing these results (see table 1) of the few studies addressing the topic of prevalence of depressive syndromes at US Colleges, the data seems to be rather inconsistent. Furthermore, the data is not gathered from a sample of elite athletes. Schaal et al. (34) conducted a representative study on psychological problems among elite athletes in France. They assessed the presence of a depressive episode with clinical interviews. In this study 4% of the athletes indicated having a current depressive episode. Lifetime-prevalence was reported to be 11%.

Research in German elite athletes

The before mentioned studies are of interest concerning the question of a possible connection between sports and depressive symptoms. However, the generalization to German elite athletes is not possible. Different supporting systems (colleges vs. squad) as well as the selective sample (only students) and possible cultural differences between the participants rule out a transfer of the found prevalence rates to German elite athletes. Thiel, Mayer and Digel (40) assessed a sample of German handball players and track and field athletes (1st and 2nd national league and A, B C and D national squad). They found that 2-4% of the athletes were experiencing feelings of melancholy, depression and unhappiness several times a week.

In a clinical perspective, these results are not valid due to missing diagnostic instruments such as a clinical interview or a validated questionnaire and therefore cannot account as prevalence rates for depression. Neither has the prevalence rate of 0.6% for antidepressants, which was gathered in a samples of athletes tested for drug abuse (23), information on the presence of depressive symptoms or a major depressive episode in elite athletes. The finding does not allow any conclusion regarding the presence of a depressive disorder, because not all depressive episodes are treated (with antidepressants) and antidepressants are also prescribed for other purposes.

However, the study from Machnik et al. (23) did find a relatively large increase of positive testing for antidepressants since 2006. The first study directly addressing the prevalence of depressive syndromes in German elite athletes was conducted by Nixdorf, Frank, Hautzinger and Beckmann (27). The study employed the clinical, validated questionnaire (ADS, German version of the CES-D, 14) to assess depressive symptoms. A conservative cut-off with a sum-score of 23 points was used in this study, in order to distinguish depression from a short-termed symptomatology or fatigue through sport related stress. With this conservative cut-off a 15 % prevalence of depressive syndromes was found among the 99 elite athletes who participated in the study. For the 35 junior elite athletes in the study a prevalence of 20% was found.

Comparised to the general German population the prevalence rates are approximately the same (in the general population a prevalence of 12% for male and 16% for female was measured with the same questionnaire). Breuer and Hallmann (3) used the randomized response technique to assess Depression. 9% of all 1154 athletes in the sample indicated to suffer from a depressive disorder. At the same time 50% indicated not to be suffering from a depressive disorder and 41% did not give an answer to that question. In terms of a clinical perspective, these findings are rarely significant due to the high amount of abstention and high subjective influence of what the participating athletes considered to be a depressive disorder by using a 3-staged answering format.

Discussion on prevalence of depressive symptomatology

As stated above, the current state of knowledge on prevalence rates of depressive symptomatology in German elite athletes is insufficient. As illustrated in table 1, some of the few existing studies did not employ valid instruments for the assessment of depression. Different cut-off values are leading to difficulties in comparison of studies and less conservative cut-off scores tend to overestimate prevalence rates. The only German study on prevalence rates using a valid questionnaire indicates that elite athletes seem to have a comparable prevalence of depressive syndromes to the general German population (27).

However, the sample of this study is not representative of German elite athletes and does not cover all sport disciplines. Furthermore, it is unclear, whether there is an overlap between some of the samples in the presented studies. In addition, there is no data on clinically diagnosed depressive episodes in German elite athletes. Furthermore, differences in prevalence for depressive symptoms between male and female, as shown in the general population, are rather speculative until now.

Whereas Storch et al. (38) found a difference in their study, showing higher prevalences in female US college students, there was no gender difference found by Nixdorf et al. (27) in their study in German elite athletes. Interestingly, the authors found a difference between athletes in team and individual sport disciplines, which was also shown in French athletes (34). Athletes in individual sports showed higher scores of depressive symptoms than athletes in team sports. This could imply that there may be specific mechanisms in elite athletes and that knowledge from the general population cannot be transferred to the population of competitive athletes without reconsideration. To focus on such mechanisms, knowledge about possible determinants will be presented in the following.

Possible determinants of depression among elite athletes

In general, the development of depressive disorders can be described by a multifactorial model of causality (42). There are biological (e.g. genetics), psychological (e.g. cognitive deficits) and social (e.g. conflicts) influences to be assumed as factors causing the incidence of a depressive disorder. While looking closer at structures in sport systems and the demands on athletes, factors associated with the incidence of depressive ›

symptoms can be identified. The following will present current topics relevant for a depressive symptomatology in elite athletes.

Stress

The tremendous psychological stress athletes are exposed to on a daily basis is frequently reported (31). Different stressors range from exercise-based and competition-based stressors (e.g. loss of a competition, cost and effort of the exercise) to everyday stressors. A growing amount of studies mentions that both, competition-based as well as sport-unrelated daily stressors are equally impairing. For example: Worrying about one's performance potential, the loss of a competition and resulting fear of failure and disaffection, conflicts with trainers, partner or family and costs of the exercise and physical demands are mentioned by ice figure skaters, golfers and tennis players as highly affecting stressors (8, 12, 33, 30).

The association between stress and psychological disorders, especially between stress and depression, is empirically validated (13, 22, 24). This has recently been replicated in elite athletes, by findings showing a connection between chronic stress and depressive symptoms (27). The question whether acute, competition-related stress has a negative impact is still uncertain up to date.

Coping

Looking at stress individual differences in how people cope with stressors play an important role. Not all athletes do perceive the above-mentioned stressors equally negative. In this connection the coping strategies of the individual athlete are of particular importance. Coping is a term, covering many strategies and behavioral activities in the process of dealing with stressors and stressful situations (35).

Studies regarding coping behavior in the general population have shown significant differences between healthy and clinical populations in the use of certain coping strategies (cf. 41). Wingenfeld et al. (41) report, that clinically depressed patients are using significantly more emotion-related coping (e.g. self-pity) than healthy control groups. Following the authors, emotion-related coping correlates positive and problem-focused coping (e.g. reaction control) correlates negative with psychopathological disorders like depression. Furthermore, studies have shown that coping strategies vary between gender (9, 18,11). Nicholls, Polman, Levi, Taylor and Cobley (26) found differences in quantity and quality regarding the use of coping strategies between different sport disciplines as well as between athletes in individual sports and team sports. First hints concerning an association between coping strategies and depressive symptomatology in elite athletes are indicated by results in German and American athletes (27, 29). Notably, the studies found a positive correlation between depressive symptoms and negative, emotion-focused coping.

Exercise stress

There seems to be an important connection between tremendous physical stress through exercise and negative mood. Exercise and therefore physical stress is essential in order for athletes to improve their performance.

However, a long-lasting imbalance between exhaustion and recovery can develop into overtraining (37). If this state persists although the athlete took a resting period of at least 2 weeks it is referred to as overtraining syndrome (4). Besides the mentioned decrease in performance this chronic state manifests itself in symptoms such as fatigue, loss of weight and appetite, sleep disturbances, emotional instability, anxiety, depressive mood, heavy transpiration, heavy muscles and frequent, small infections (4, 5, 6, 7).

Naming these symptoms strong similarities to the depressive symptoms are obvious. Armstong and VanHeest (1) indicate, that there are in fact great overlaps in the symptomatology (e.g. loss of appetite and weight, insomnia or fatigue).

Furthermore the authors report, that there are comparable changes in the vegetative nervous system and the associated neurotransmitters. They conclude, that the overtraining syndrome might have a similar etiology to depression. Puffer and McShane (31) also indicate a connection between overtraining and depression. Following their argumentation depression may appear without fatigue, but is far more frequent seen with physiological fatigue in athletes.

Empirical studies point into the same direction. For example, O'Conner, Morgan, Raglin, Barksdale and Kalin (28) found a significant correlation between higher exercise loads and depressive mood in swimmers. In Germany a strong association was found between the balance of stress and recovery and depressive symptoms (27). Athletes with high scores in exhaustion and low scores in recovery were suffering stronger by depressive syndromes than their recovered colleagues. Scientific research on overtraining demonstrates the importance of physiological changes (e.g. through the hormones leptin and insulin or through cytokines) and their influence on central nervous processes in the hypothalamus by chronic exercise loads (37). These changes may be reflected in psychological markers such as mood or feelings of fatigue.

Besides the physiological stress, an interaction with psychological factors (e.g. recreational activities) might be assumed (21). However, the mechanisms and explanations concerning this connection and interaction are still to be explained.

Individual and social factors

Besides the above-mentioned factors, individual and social aspects in elite athletes should be considered. In this regard, specific personality traits that might have an influence on depressive symptoms are of interest. Research in the general population found associations between perfectionistic personalities and a higher vulnerability for the development of depression (e.g. 15, 16). Regarding elite athletes, empirical evidence for this assumption is still lacking. However, there is evidence for a connection between burnout and perfectionism (17).

Social aspects, for example team cohesion, associated supporting systems like managers and coaches, and social competence and skills of individual athletes might have an impact, too. Results from studies with American collegiate athletes indicate the importance of such social factors. Following these findings, depressive symptoms were associated with feelings of social connectedness (2, 38). However, these results refer to athletes as well as to standard students. In elite athletes, correlations were found indicating such possible mechanisms for depressive syndromes (e.g. 39).

Conclusion

Following the present studies, depression in elite athletes is more than just a media controversy. Meanwhile, empirical data illustrate the relevance of this topic. However, there are too few studies in order to draw representative conclusions. Especially studies with clinically valid criteria for the assessment of prevalence rates are rarely found. Therefore, diagnoses have to be made by psychotherapists or psychiatrists. In order

to get valid data further research is needed, taking into account clear diagnostic procedures following the ICD-10 criteria (10) and assessment in a representative population in various sport disciplines. In order to be able to evaluate possible overlapping in the sample and the representativeness of the participants, researcher should state in detail their assessed participants which is often not the case in existing studies.

Furthermore, levels of depressive symptomatology and underlying determinants might not be transferred equally from the general population to elite athletes. Specific influences, such as exercise demands, sport specific stressors or differences due to sport disciplines need special attention in research. Hence, knowledge from depression research can be used, but should be empirically validated in elite athletes. In addition, sport specific factors (e.g. stressors, physical demands, etc.) should be taken into consideration. A few associated factors have been identified up to now. These factors are: Chronic stress, which elite athletes might be particularly exposed to; coping strategies, which especially might play an preventative role and an imbalance in exhaustion and recovery in sport specific areas as well as in general areas. Research assessing detailed association and differentiation to topics such as overtraining might lead to further evidence in this regard.

In order to gain further knowledge (e.g. for prevention programs) determinants and mechanisms should be investigated. Therefore longitudinal study designs are needed in order to draw causal conclusions. The current evidence has potential for hypotheses regarding mechanisms, which must be validated in appropriate study designs. The yet present, explorative studies might be able to gain more evidence by having an approach, which is more driven by hypotheses and theories. Furthermore, in analyzing developmental factors assessment of depressive symptoms through valid instruments is important in order to make clear statements about depressive syndromes and their connections to these factors. In this regard, it is important to have an active communication between researchers, sport organizations, clubs and associated supporters. ■

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3.2 Study 2: Burnout and depression in junior elite athletes

Title:	Analyzing the relationship between burnout and depression in junior elite athletes
Authors:	Raphael Frank, Insa Nixdorf & Jürgen Beckmann
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This study was part of the previously-mentioned project founded by the BISp. The goal was to analyse the relation between burnout and depression in a cross-sectional and longitudinal study design. This approach provided the possibility to analyse a larger sample cross-sectionally, considering other constructs such as recovery and chronic stress as well. Thus, burnout and depression could be related regarding other associated constructs. Furthermore, we used the longitudinal assessment to approach the temporal link between depression and burnout in a cross-lagged panel design; and we implemented structural equation modelling to approach the possible links over time between both constructs.

As the first author, I mainly conducted, planned, executed and wrote the present study and the paper. Substantial support from the other authors was welcomingly appreciated.

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Analyzing the Relationship Between Burnout and Depression in Junior Elite Athletes

Raphael Frank, Insa Nixdorf & Jürgen Beckmann

Technical University Munich

Abstract

Findings on burnout and depression in athletes highlight their potential severity. Although both constructs are discussed in similar, stress-based concepts, it is unclear how they relate to each other. To address this issue, we conducted a cross-sectional multiple linear regression analysis (MLR; N = 194) and a longitudinal analysis of a three-wave cross-lagged panel (CLP; n = 92) in German junior elite athletes. MLR showed depression and burnout were both associated with chronic stress. Stress was a significant better predictor for both burnout and depression than each was for the other. CLP analysis on the constructs of burnout and depression revealed support for cross-paths in both directions. Thus, burnout and depression might cause each other to some degree, with no distinct direction of this link. However, as both syndromes do not fully explain each other, interchanging both terms and syndromes should be avoided. Preferably, future research might consider the transfer of knowledge between both syndromes in order to draw founded conclusions.

Keywords: athlete burnout, chronic stress, recovery, cross-lagged panel, mental health

Burnout and depression can be considered important aspects in the context of psychological problems in athletes (e.g. Gouttebarge, Frings-Dresen, & Sluiter, 2015; Gulliver, Griffiths, Mackinnon, Batterham, & Stanimirovic, 2015). Both syndromes affect athletes on physical and emotional dimensions and have the potential to negative outcomes by their main symptoms, but also in maintaining their athlete career due to fear of being exposed (Doherty, Hannigan, & Campbell, 2016). Although research is addressing each syndrome among athletes (for review see Eklund & DeFreese, 2015; Wolanin, Gross, & Hong, 2015) findings on the relation of both constructs are largely missing, especially in the context of sports. Therefore, there is a lack in useful information on how burnout and depression are related and how they might affect each other.

Research on burnout in elite sports appeared in 1984 (Caccese & Mayerberg, 1984) followed by many reviews (Dale & Weinberg, 1990; Eklund & DeFreese, 2015; Fender, 1989; Goodger, Gorely, Lavallee, & Harwood, 2007), which illustrate the rapidly expanding field of research since then. In addition, the concept of burnout was adapted for the domain of sports and called *athlete burnout* form thereon. Athlete burnout is characterized by three core dimensions (see table 1), which are a) physical and emotional exhaustion, b) sport devaluation and c) reduced sense of accomplishment (Raedeke & Smith, 2001).

Research on depression in elite athletes is only recently evolving, with the first articles on depression tending to be more theoretical and pointing to overlaps with overtraining and the physical demands in elite sports (L. E. Armstrong & Van Heest, 2002; Puffer & McShane, 1992). Symptoms of depression include depressed mood, anhedonia, fatigue, feelings of guilt and suicidal ideation (see table 1). Furthermore, depression can be regarded as a multisystem disorder with affective, cognitive and physiological manifestations (Insel & Charney, 2003; Lee, Jeong, Kwak, & Park, 2010). Empirical data was mainly established in college athletes (S. Armstrong & Oomen-Early, 2009; Storch, Storch, Killiany, & Roberti, 2005; Yang et al., 2007) and recent research on this matter recognizes the relevance and in some cases the severity of depressive syndromes in athletes (Gulliver et al., 2015; Nixdorf, Frank, Hautzinger, & Beckmann, 2013; Wolanin, Hong, Marks, Panchoo, & Gross, 2016). Reviews on this matter argue that in spite of rather high prevalence of depression in athletes, both, theoretical testing of frameworks and empirical studies of depression's relationship to other constructs (such as burnout) are missing (e.g. Frank, Nixdorf, & Beckmann, 2013; Wolanin et al., 2015).

At this stage, knowledge from research on athlete burnout could possibly enhance knowledge on depression in athletes and vice versa. However, the connection and possible developmental mechanisms between both constructs have not been scientifically elaborated so far. Still, burnout is often considered as a part, or a sub-category of depression (for review see Bianchi, Schonfeld, & Laurent, 2015). Even though burnout and depression may show symptoms which could be roughly related (table 1), Cresswell and Eklund (2006) point out that they are two different constructs and their theoretical distinction needs

empirical clarification. Even in the general population, very few studies address this issue (Bianchi et al., 2015). The results of these studies indicate that the constructs share elements but essentially address different phenomena (Bakker et al., 2000; Toker & Biron, 2012). However, results on how these different construct are related over time are rare.

Table 1. *Symptoms of depression and athlete burnout*

Depressive symptoms (according DSM V, American Psychiatric Association, 2013)	Athlete burnout core symptoms (according Raedeke & Smith, 2001)
– Depressed mood	– Physical and emotional exhaustion
– Fatigue or loss of energy	– Reduced sense of accomplishment
– Anhedonia (loss of interest and pleasure)	– Sport devaluation
– Change in weight	
– Insomnia or hypersomnia	
– Psychomotor agitation or retardation	
– Feelings of worthlessness and/or guilt	
– Impaired concentration or decision making	
– Suicidal ideation	

Note. Symptoms above the dashed line are representing major criteria for each construct.

Theoretical frameworks for depression and burnout in athletes

Examining the theoretical frameworks, athlete burnout and depression are often conceptualized in a stress-based model. Adapting developmental concepts of burnout to the context of sports we find three different starting points: (1) based on personal factors (Smith, 1986), (2) based on condition (Coakley, 1992) and (3) an integrated burnout model based on both (Gustafsson, Kentta, & Hassmen, 2011). Smith (1986) saw burnout as a potential outcome for an athlete who is unable to efficiently cope with the chronic psychological stress involved in elite sports, such as training loads and competitions. Coakley (1992) on the other hand assumed that burnout arose due to the structure and conditions of sport environments, assuming adolescent athletes lost autonomy and developed narrow, sport-centered identities, which led to burnout. More recently, Gustafsson et al. (2011) suggested an integrated burnout model which includes many of the antecedents (perceived sport stress, unidimensional athletic identity, less adaptive forms of sport motivation, etc.).

The development of depression is commonly described by a vulnerability-stress model (e.g. Alloy et al., 2006; Haffel et al., 2005; Hyde, Mezulis, & Abramson, 2008). Here certain vulnerabilities (genetics, social support or isolation, cognitive distortions, etc.) in combination with a stressor (chronic or acute) can lead to depression (Lee et al., 2010). Findings among athletes also illustrate the relation to stress (Nixdorf et al., 2013) and certain stressors such as training loads, pressure to perform well (Nixdorf, Frank, & Beckmann, 2015) or an important competition (Hammond, Gialloreto, Kubas, & Davis, 2013).

Relation between depression and burnout in athletes

By illustrating these theoretical frameworks for burnout and depression, stress appears to be a shared, important factor. Therefore, both constructs might be connected by its relation to stress. Regarding the definition of burnout, the symptoms are related as a response to occupational stress (Maslach, Schaufeli, & Leiter, 2001), which is also highlighted in the core dimensions for athletes (Raedeke & Smith, 2001). Here, sources of stress are clearly related to a person's occupation. On the topic of depression, recent research in elite athletes illustrated connections to sport-related factors including injuries (Kerr, Marshall, Harding, & Guskiewicz, 2012; Mainwaring, Hutchison, Bisschop, Comper, & Richards, 2010), overtraining (L. E. Armstrong & Van Heest, 2002), failure during competition (Hammond et al., 2013) or effects of the sport discipline (Nixdorf, Frank, & Beckmann, 2016; Schaal et al., 2011; Wolanin et al., 2016). Furthermore, an exploratory analysis of major stressors revealed higher depression scores for athletes, with stressors mainly related to their sport and the demands within (Nixdorf et al., 2015). These findings point to a large amount of stress evolving within the sport context, which also might support the stress-based connection between burnout and depression in athletes.

Besides their conceptual relation, their temporal and therefore developmental relation is largely uncertain and only few studies execute this idea and investigate processes between burnout and depression among the general population (Bianchi et al., 2015). In regards to burnout, some researchers proposed a process model (Hallsten, 1993; Leiter, 1993; Van Dierendonck, Schaufeli, & Buunk, 2001). In this line of thought, burnout would represent a process of milder symptoms of burning out with eventually developing a severe burnout syndrome at a later phase. This assumption regarding burnout is also considered in elite sports (Gustafsson, Kenttä, Hassmen, Lundqvist, & Durand-Bush, 2007). Such considerations however are primarily mentioned in burnout development.

Conceptions around a temporal link between depression and burnout are rather uncertain. Therefore, it remains unclear whether depression precedes burnout or the association is inversely; or if both are not linked in their development. It is therefore not surprising that some studies address depression as an outcome of burnout (Armon, Melamed, Toker, Berliner, & Shapira, 2014; Hakanen & Schaufeli, 2012). This assumption seems to be in line with the before mentioned process-model of burnout with rather severe symptoms such as depressive mood at a later stage (Gustafsson, Hassmen, Kenttä, & Johansson, 2008). However, other studies point to contrary directions finding burnout a possible consequence of depression (Armon, Shirom, & Melamed, 2012; Campbell, Prochazka, Yamashita, & Gopal, 2010). In addition, bidirectional links were found indicating an interaction between both syndromes (Ahola & Hakanen, 2007; Toker & Biron, 2012). On the matter of elite sports, the literature is even less on this issue. However, evidence on the temporal relation of burnout and depression would bare useful knowledge on plausible developmental theories. Furthermore, it would give hints for applied practice by pointing out underlying mechanism for both syndromes on which prevention might be based on.

In elite sports, we find only one study which clearly addresses burnout and depression jointly among this population. The cross-sectional study of De Francisco, Arce, Vílchez, and Vales (2016) found connections between burnout, depression and perceived stress among athletes in Spain. Here again the possible link between burnout and depression via stress is highlighted. On a conceptual level, the authors regarded depression rather an outcome of burnout. However, as the above mentioned results in the general population highlight possibilities for both directions, clear direction cannot be assumed at this stage and a link in both directions should be explored. As already pointed out, longitudinal evidence is needed in order to approach temporal assumptions between burnout and depression.

Consequently, the present study addresses the questions: (1) Are depression and burnout related in athletes? (2) How are depression and burnout related in comparison with other stressors? (3) In which direction is the temporal relation between burnout and depression? In order to approach these questions, we assessed a junior elite athletes sample both cross-sectionally and longitudinally. For the cross-sectional analysis, we assessed burnout and depression along with stress measurements such as chronic stress and the current state of recovery. We expected burnout to be correlated with depression (hypothesis 1). We further hypothesized that both syndromes were linked to stress (hypothesis 2). For the longitudinal assessment, we explored the temporal and causal relation between burnout and depression solely in a cross-lagged panel design, and hypothesized that higher levels of either burnout or depression led to higher levels of the other respectively (hypothesis 3).

Method

Participants

Participating junior elite athletes were recruited from a scientific project in order to investigate and help prevent depression and burnout in young elite athletes. The project's goal was to enhance knowledge on burnout and depression. Gathered information should be transferred into recommendations for prevention. Initial contact details were provided by officials in the participating sport associations or sport clubs. Participating athletes were contacted via email and additionally informed in an initial information meeting. Therefore, only junior athletes with high competition level (at least regional selection squad or members in professional junior development facilities) were included in the study. Participants came from different sport disciplines: Mountain biking, badminton, gymnastics, swimming, speed skating, short track, soccer and hockey. For the cross-sectional analysis, (N = 194) German junior elite athletes (Mage = 15.08; SD = 1.95) provided data on questionnaires on depression, burnout, chronic stress, and recovery. For the causal analysis in the 3-wave cross-lagged panel, n = 92 German junior elite athletes (M_{age} = 14.82; SD = 2.26) provided data on the measurements for depression and burnout.

Measures

Depression. Depressive symptoms in junior athletes were assessed with the widely used German version of the Center for Epidemiologic Studies Depression Scale (CES-D) from the National Institute of Mental Health (Hautzinger, Bailer, Hofmeister, & Keller, 2011; Radloff,

1977). The CES-D is a short self-report scale designed to measure depressive symptomatology in the general population. It has also repeatedly been used to assess depressive symptoms among elite athletes (e.g. S. Armstrong & Oomen-Early, 2009; Junge & Feddermann-Demont, 2016; Yang et al., 2007). The 20 items are assessed on a scale ranging from 0 to 3. The scale is reliable and standardized for the age range 11 – 90 years. The scale has been found to have high internal consistency (α = .89), which was in the present sample α = .85.

Burnout. Symptoms of Burnout in athletes were assessed using the Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001) in its German version (Ziemainz, Abu-Omar, Raedeke, & Krause, 2004). The ABQ is a self-report scale designed to assess the three core dimensions in athlete burnout: physical and emotional exhaustion, sport devaluation, and reduced sense of accomplishment. The questionnaire consists of 15 items on a scale ranging from 0 to 3. The scale had previously be shown to be valid and reliable (Ziemainz et al., 2004) and also had acceptable internal consistency with Cronbach's α = .86 in the present sample.

Chronic stress. The Screening of the Trier Inventory of Chronic Stress (TICS;Schulz, Schlotz, & Becker, 2004) was used for assessing chronic stress in the last 3 months. The 12-item scale is a short self-description screening with items covering frequencies of experiences and feelings during the last three months. Answers are coded on a 5-point Likert scale ranging from 0 (*never*) to 4 (*very often*). The scale has been found to be valid and reliable (Schulz et al., 2004) in the general population. In German junior athletes, the scale was validated and normed and had a reliability of Cronbach's α = .87 (Sallen & Hoffmann, 2012). Internal consistency in the present study was good with α = .90.

Recovery. Current state of recovery was assessed using a short self-description protocol adopted from the RESTQ-Sport (Kellmann & Kallus, 2001). The RESTQ-Sport is often used for assessment and monitoring of stress and recovery states among athletes (for review see Kellmann, 2010) and provides good psychometric properties (Kellmann & Kallus, 2001). The protocol uses the most important items in covering key aspects of the RESTQ-Sport (Kellmann, 2000). The questionnaire covers the last week and therefore provides a measure of current individual state of recovery. The internal consistency of the used scale was acceptable with Cronbach's α = .79.

Procedure

After review and approval of the protocol, participating athletes and their parents provided written informed consent. Data was assessed anonymously and pre-season in all sport disciplines with an online questionnaire battery. In case of interest or for further information on personal data, participants could use an individual code to access their individual data. Longitudinal data was assessed at specific, predetermined times in the sport schedule. Times of assessment were: T1 preparation phase, T2 competition phase and T3 recovery phase. Therefore, dates were adjusted to the seasonal schedule to each sport discipline resulting in time intervals specific to each sport.

Statistical analysis

For the cross-sectional sample, we performed correlational analysis between the constructs (burnout and depression). We also performed multiple linear regression (MLR) for the question regarding the stress connection of both constructs (H2). MLR was performed with forced entry of all assessed constructs (burnout, depression, chronic stress and recovery) and standardized estimates (*b**) were calculated, providing an opportunity to compare the different predictors.

In the three-wave cross-lagged panel, structural equation modeling (SEM) was used to compare plausible models and identify possible cross-paths between both constructs over time. Using this cross-lagged panel model (CLPM), various models with only differences regarding their cross-lagged paths were modeled and compared. For appropriate evaluation of the model fit, we used the following fit indices to minimize impact of sample size: Comparative fit index (CFI) and Tucker-Lewis Index (TLI). In addition, we used the standardized root mean square (SRMR), the mean square error of approximation (RMSEA), Akaike's information criterion (AIC) and the Bayesian information criterion (BIC) to further evaluate model fit. Lower levels of AIC and BIC indicate better model fit. Regarding the other fit indices, we use the following cut-off values indicating acceptable fit: CFI < .90; TLI > .90; SRMR < .10; whereas the following indices indicated good model fit: CFI > .95; TLI > .95; SRMR < .08 (Marsh, 2004).

Comparison of appropriate models was performed by using Satorra-Bentler chi-square difference tests (Satorra & Bentler, 2001). As Usami, Hayes, and McArdle (2015) point out, correct selection rates tend to be higher when using model fit indexes like the CFI or the RMSEA (mean square error of approximation) than when using a likelihood ratio test or any of several information criteria (i.e., Akaike's information criterion, Bayesian information

criterion, consistent AIC, and sample-size-adjusted BIC). Therefore, CFI and RMSEA were treated with certain priority in model selection.

Results

Cross-sectional analysis

Mean sum scores (with standard deviations in parentheses) in the present sample were 10.30 (7.14) for depression, 16.64 (8.06) for burnout, 15.93 (8.26) for chronic stress and 26.68 (6.77) for recovery. Correlation between athlete burnout and depression was moderate (r = .59; p < .001). Further correlations between the constructs (table 2) showed moderate to strong correlations between all measured constructs. Therefore, multiple linear regression provided further insights. Regarding the analysis with depression as the dependent variable, recovery (b^* = -.28; p <.001) and chronic stress (b^* = .46; p <.001) appeared as valuable predictors. Notably, burnout was not a significant predictor (b^* = .09; p = .223) in the model with all predictors. The overall model was significant with $F(3, 190) = 75.39$; $p < .001$ with a adjusted $R^2 = .54$.

Table 2. *Pearson correlation between depression, burnout, and state of recovery.*

	Burnout	Chronic Stress	Recovery
Depression	.59**	.69**	-.61**
Burnout	-	.72**	-.58**
Chronic stress	-	-	-.59**

Note. **p < .001

The model for burnout as the dependent variable had comparable results with $F(9, 190) = 81.02$; $p < .001$ with an adjusted $R^2 = .55$. Here, chronic stress in particular significantly predicted athlete burnout (b^* = .54; p <.001). Furthermore, recovery (b^* = -.21; p <.001) showed significant value as a predictor. Depression was again a non-significant predictor for burnout (b^* = .05; p = .451).

Table 3. *Multiple linear regression results for depression*

	*b**	*SD*	*t*	*p*
Burnout	.09	.05	1.22	.223
Recovery	-.28	.06	-4.52	<.001
Chronic stress	.46	.07	6.23	<.001

Table 4. *Multiple linear regression results for burnout*

	*b**	*SD*	*t*	*p*
Depression	.09	.07	1.22	.223
Recovery	-.21	.06	-3.37	<.001
Chronic stress	.54	.07	7.75	<.001

Cross-lagged panel analysis

Before employing CLPM, data was screened for multivariate outliers. Ten participants showed a Mahalanobis distance larger than the critical value of $\chi^2(6) = 12.59$, $p < .05$. As Mardia's multivariate skewness statistic was critical with 6.18 ($p < .05$), robust maximum likelihood estimation was used. For analysis of the cross-lagged panel data, CLPM was employed and models with different cross-lagged paths were compared. This approach is commonly used, even in comparably small sample sizes (e.g. N = 85; Zacher & de Lange, 2011). To enhance statistical power, path coefficients between second and third wave were constrained to equal their counterpart between first and second wave. Thus, the third wave had to replicate the previously modeled pattern.

As a baseline, model 1 (stability) included only stability paths for burnout and depression. In this model no cross-path was included and the stability paths from T1 over T2 to T3 were constrained to be equal within both constructs but allowed to vary between the constructs. Model 2 (burnout → depression) additionally included the cross-paths from burnout to depression (burnout T1 → depression T2; burnout T2 → depression T3). Model 3 (depression → burnout) included the equivalent cross-paths from depression to burnout (depression T1 → burnout T2; depression T2 → burnout T3). In both models (model 2 & 3), the additional cross-paths were constrained to be equal to explore the possible general mechanisms and increase statistical power by the third wave of follow-up. Model 4 (vice versa constrained) included both cross-paths from model 2 and model 3. Here, all of these 4 cross-paths were constrained to be equal. In model 5 (vice versa) only cross-paths with the same direction (burnout →depression vs. depression →burnout) were constrained to be equal. In contrast to model 4, model 5 allowed paths coefficients from burnout to depression and path coefficients from depression to burnout to differ in their value.

Table 5. *Structural equation modeling results including model fit indices and model comparison*

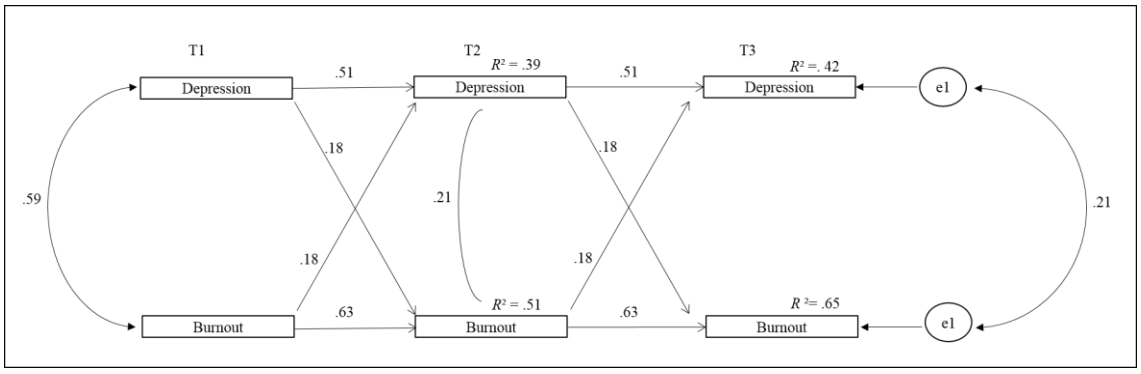
Model	χ^2	*df*	CFI	RMSEA	TLI	SRMR	AIC	BIC	Comparison	Δ_{χ^2}	Δ_{df}
1) Stability only	24.94**	10	.93	.14	.89	.14	1143.20	1183.91			
2) Burnout → Depression	42991	9	.98	.08	.97	.06	1131.90	1175.00	1) vs. 2)	9.98**	1
3) Depression → Burnout	15.14	9	.97	.09	.95	.09	1135.16	1178.26	1) vs. 3)	14.45***	1
4) Vice versa constrained	29037	9	1.00	.00	42736	.05	1126.65	1169.75	1) vs. 4)	21.45***	2
5) Vice versa	13697	8	1.00	.00	42736	.05	1128.18	1173.68	1) vs. 4)	19.20***	2
									5) vs. 2)	8.82**	1
									5) vs. 3)	6.98**	1
									5) vs. 4)	0.42	1

Note: *<.05; **<.01; ***<.00

Results for the structural equation modeling (table 5) show acceptable fit indices for the stability model (CFI = .93), however other indices did not reach classical benchmarks of significance (RMSEA = .14; SRMS = .14; TLI = .89). The inclusion of the cross-paths from burnout to depression (model 2) improved all indices of model fit. The same could be observed by including the cross-paths from depression to burnout (model 3). Comparison of both models with the stability model (model 1) showed a significant chi-square value ($\chi^2(1) = 9.98$; $p < .01$ for model 2 and $\chi^2(1) = 14.45$; $p < .001$ for model 3). The inclusion of both cross-paths (models 4 & 5) also improved all fit indices in comparison to model 1 and led to a significant chi-square test. Both models (model 4 & 5) demonstrate adequate important indices of fit (CFI = 1.00 and RMSEA = .00) and only slightly differ for some fit indices. Model 4 has, due to its constrains, the most degrees of freedom, and the comparison with model 5 ($\chi^2(1) = 0.42$; $p = .519$) had no additional significant improvement. Therefore, model 4 offers the most promising fit. And notably, model 4 seems favorable over model 2 ($\chi^2(1) = 8.82$; $p < .01$) and model 3 ($\chi^2(1) = 6.98$; $p < .01$), thus highlighting the importance of both cross paths.

Figure 1 offers an overview over model 4 and its path coefficients. Autoregressive paths are moderate for depression (b = .51, $p < .001$) and burnout (b = .63, $p < .001$). Due to its constraints, all cross-paths have the same value (b = .18, $p < .001$), which is relatively small. However, cross-paths demonstrate a significant value to the overall fit and should be included due to the previous model-selection.

Figure 1. Model 4 (vice versa constrained). All path coefficients are standardized. T1 = Time 1, preparation phase; T2 = Time 2 competition phase; T3 = Time 3, recovery phase.



Discussion

The present study empirically assessed the relationships between burnout and depression among junior elite athletes, and therefore contributes to a currently evolving field of research. Cross-sectional analysis provided support for the first assumption, namely that burnout and depression are related among athletes. This could be expected as research in the general population is more concerned with the question how both constructs are differentiated than with finding similarities (Bianchi et al., 2015).

Further analysis showed that burnout and depression were both associated with stress-based aspects of sports (chronic stress and current state of recovery). However, burnout as well as depression, was mostly explained by stress (chronic and current lack of recovery) rather than the counterpart (burnout for depression and vice versa), which did not improve the linear regression model. Therefore, stress might be important for explaining the found association between burnout and depression. Without this connection through stress, burnout and depression might represent

different psychological constructs with little relation.

This finding also supports stress-based theories for burnout (Gustafsson et al., 2011; Smith, 1986) and depression (Alloy et al., 2006; Lee et al., 2010). It shows that both constructs seem to be highly stress-related, especially in a young sample with presumably high stress. In line with studies on burnout or depression in athletes (Cresswell, 2009; De Francisco et al., 2016; Nixdorf et al., 2013), the present finding deepens the stress-based assumption for both constructs. Research on stressors demonstrate various sources of stress for elite athletes based on the demands they have to deal with (Fletcher & Hanton, 2003; Fletcher, Hanton, Mellalieu, & Neil, 2012; Tabei, Fletcher, & Goodger, 2012). Therefore, the connection between stress and mental health problems, like burnout or depression, might be even more apparent in the present sample. At the same time, we highlight the need to be sensitive in regards to athletes' amount of stress and their abilities to cope with this stress.

Longitudinal results from the CLPM provide support for a bidirectional association between burnout and depression. Therefore, burnout and depression can cause each other to some degree and no particular direction can specifically be supported by the present study. This pattern was also found in previous studies in the general population (e.g. Ahola & Hakanen, 2007; Toker & Biron, 2012). Therefore, neither burnout nor depression can be expected as a clear predecessor of the other construct. Moreover, depression and burnout both appear to be relatively stable over time with certain influences from one to another. As already stated by Toker and Biron (2012) this bidirectional link between burnout and depression would be in accordance with theories pointing to possible loss spirals, such as assumptions from conservation of resources theory (COR; Hobfoll, 2001, 2011) where loss of resources in one domain may further exacerbate the depletion of resources in other domains. The present findings point to such a process of reciprocal exacerbation of symptoms comparable to a loss spiral rather than a directional process with a possible final state. Consequently, the mere focus on one construct (such as athlete burnout in current research) would bear the risk of overlooking important mechanisms at an earlier state. Assumptions on a process of burnout with developing depressive symptoms at a later stage (e.g. Gustaffson et al., 2007) imply a direction from burnout symptoms to depression. Thus, focusing on burnout in order to explore predictors and mechanism seems plausible. But, since the present data also shows the inverse link, from depression to burnout, this assumption would be too narrow and important mechanisms would be overlooked. Therefore, research in and prevention of syndromes such as burnout and depression should address both constructs. In addition, other constructs might play an important role in the relation between burnout and depression. The present study focused on its link in a stress-based concept. However, other links, such as motivational or environmental factors might contribute to the understanding of burnout, depression and its relation.

In order to gain further evidence, research might consider adapting and validating knowledge from each field of research to the other. For example, there is some effort in research on the relation between injuries and depression (e.g. Appaneal, Levine, Perna, & Roh, 2009; Junge & Feddermann-Demont, 2016; Mainwaring et al., 2010), whereas motivation is mainly assessed in regards to burnout (e.g. Cresswell & Eklund, 2005; Lemyre, Roberts, & Stray-Gundersen, 2007; Madigan, Stoeber, & Passfield, 2016). Thus, evaluating motivational assumptions in regards to depression and testing relations between injuries and burnout seems plausible. In general, the adaption and transfer of findings could possibly improve knowledge for preventing burnout and depression. Furthermore, results on such transferal studies might deliver possibilities for comparison of important factors for each syndrome and thus help unravel the relation between them.

Limitations

The present study highlights some important aspects of the relation between depression and burnout in junior elite athletes. However, the analysis of the CLPM is mainly concerned with their temporal or causal relation. By doing so, we assume both constructs are different and results for the CLPM are not able to distinguish the constructs (Bianchi et al., 2015). There are further constraints to the present study such as the relatively small sample size in the CLPM. Therefore, generalization of the present findings should be made with caution. The present sample of junior athletes might not be representative for the population of elite athletes in general. Furthermore, although assessing clinically relevant constructs, the present findings are concerned with their relation and possible mechanisms rather than the clinical relevance of depression or burnout in the present sample.

Conclusion

Research on burnout and depression increased over the past decades and both constructs have been pointed out as important aspects for athlete's well-being. However, the relation between depression and burnout is largely uncertain, especially among athletes. Therefore, the present study contributes to this gap of knowledge by specifically addressing this issue

among junior elite athletes. The study points out that depression and burnout in athletes are connected and have a clear relation to stress. However, it is also apparent that the focus on either burnout or depression fails to explain the picture fully. As long as the relation and mechanisms are not addressed in more detail, processes and comorbidities should not be neglected in research. This would not just help enlighten the relation between depression and burnout in research, but also help understand the syndromes and therefore provide knowledge to enhance prevention in the applied field. For practitioner a founded knowledge on both syndromes is needed on which predicting factors are important for the syndromes. Also in terms of screening for athletes at risk it is important to know about the relation and interplay between both syndromes.

At the same time, there is a need for research to agree on a definition and conceptualization of burnout. Only with a clear definition, there is a chance to distinguish and relate both constructs with more certainty in the future. The present findings illustrate that there might not be a clear starting point and the development of psychological syndromes might appear with different symptoms in a non-linear manner. Therefore, prevention of these psychological problems has to be of major concern in both constructs. Moreover, the integration of more than just one syndrome in prevention programs might be necessary and the focus on just one syndrome may increase the risk of potentially overlooking important aspects.

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4 Discussion

The present dissertation captures the field of depression and burnout in elite and junior elite athletes. The first study described the current state of knowledge on depressive syndromes, discussed prevalence rates and associated factors, and provided guidance for further research. The second study related depression to athlete burnout and specifically examined their conceptual relationships to stress as well as their temporal inter-relation. Both studies are discussed in the previous articles; thus I primarily address conclusions and assumptions beyond the aspects already discussed inside the publications.

4.1 Depression in elite athletes

As already mentioned, research on depression in athletes is growing, but still comparatively rare. The review article illustrated that prevalence of depression in athletes varies depending on the country, sample, measurement methods, and/or the status of the athletes (e.g. injured, retired). Recent results (e.g. Hammond et al., 2013; Nixdorf et al., 2015) suggest that this heterogeneity is due to further variables such as the time of assessment (phase, periodization) or other demographic variables (e.g. age, wins and losses; present sport funding, Olympic season). Thus, a clear and precise description of the assessed sample is necessary in order to relate findings to each other.

A precise evaluation of the prevalence rates seems difficult. Estimates might be made more accurate over time, given more empirical data and information on this issue. In this regard, it is important to consider as much information as possible to draw conclusions. Thus, the relationship to the equivalent general population and the used measurement should be of a minimum standard. Conservatively, the overall severity and prevalence of depression in athletes might be stated to be as at least as high as in the general population. This might be surprising considering the physically fitness level and the presumed level of functioning in elite athletes, as mentioned in the introduction to this dissertation. However, this surprise might also reflect the possible false assumptions of athletes, such as being tough, aggressive and getting things done all the time (Biskup & Pfister, 1999). Therefore, the importance of researching and promoting athletes' mental health is not only illustrated by the high prevalence, but also by the conflict between these prevalence rates and the perceptions of sport spectators and athletes themselves (Doherty et al., 2016; Stephan & Brewer, 2007).

Since the publication of study 1 further empirical studies on depression in elite athletes have been conducted and published. In order to provide a current overview, subsequent articles have been added to the summary in table 2. These newer studies further contribute to the already stated severity of depressive syndromes among elite athletes. Results from Australian elite athletes (Gulliver, Griffiths, Mackinnon, Batterham, & Stanimirovic, 2015) and from North American athletes (Wolanin et al., 2016) showed comparable rates: 26,5 and 26% of assessed athletes were at risk for depressive symptoms, using the CES-D and a low cut-off score of 16. Also underpinned is the importance of considering the athletes' situation at the time of assessment. The found prevalence of 60 % by Hammond et al. (2013) before a championship tournament might certainly illustrate this importance.

Also noteworthy is the commonly-used cross-sectional approach and the assessment of demographics along with mental health aspects (Gouttebarge, Frings-Dresen, & Sluiter, 2015; Junge & Feddermann-Demont, 2016; Schaal et al., 2011; Wolanin et al., 2016). These data contribute to enhancing the picture of the current state of research on depression and clinical disorders in athletes. However, little information is gathered on developmental factors and therefore on chances for prevention of mental disorders. Thus, theoretically-assumed mechanisms and associations should be examined in future research (Frank, Nixdorf, & Beckmann, 2013). In this regards, demographic effects such as different scores across sport disciplines (Wolanin et al., 2016) or between tournaments (Hammond et al., 2013) can further be investigated to identify possible underlying mechanisms. Nixdorf et al. (2016) might offer a useful example in this regard by pointing out negative attribution after failure as a mediator for higher depression scores in individual sport disciplines.

Table 2

Overview of studies on depression in elite athletes - updated

Depression assessment	Sample of athletes	Design	Prevalence, rounded	Assessed factors related to depression	Study
interview by experts	N = 2 067 Representative sample in France sport disciplines unknown	cross-sectional design for assessment of prevalence	last 6 months: 4% life-time: 11%	differences across sport disciplines and gender further clinical disorders	Schaal et al., 2011
ADS Cut-off = 23	N = 162 (99 profess.; 35 youth) German athletes 18 sport disciplines	cross sectional; correlational online study	professionals: 15% youths: 20%	chronic stress, coping, exhaustion & recovery	Nixdorf et al., 2013
CES-D Cut-off = 16	N = 257 College, USA 13 Sport-teams	cross sectional; correlational study	21% (Cut-off = 23: 6%)	state und trait anxiety „freshman“	Yang et al., 2007
	N = 66 College, USA Baseball player	cross-sectional; comparison athletes vs. Non-athletes	16%	coping	Proctor & Boan-Lenzo, 2010
	N = 104 (Athletes) College, USA sport disciplines unknown	cross sectional; correlational study	33.5%	self-worth, social connectedness, sleep	Armstrong & Oomen-Early, 2009
PAI Cut-off = 32	N = 105 (athletes) College, USA soccer, volley-, basket- and football, tennis, swimming	cross-sectional; comparison athletes vs. Non-athletes	female 10% male 4%	social anxiety, problems with alcohol, perceived social support differences between gender	Storch et al., 2005
single questions on "melancholy, depression, unhappiness"	N = 723 German athletes Handball, athletics	cross-sectional	2-4% (several times a week)	-	Thiel et al., 2010

Depression assessment	Sample of athletes	Design	Prevalence, rounded	Assessed factors related to depression	Study
self-rating on categories „honestly yes“, „honestly no“, „no answer“	N = 1 154 German athletes sport disciplines unknown	cross-sectional; online assessment, *Randomized Response Technique*	9%	-	Breuer & Hallmann, 2013
positive testing on antidepressants	N = 82 880 50 nations 178 sport disciplines	cross-sectional and longitudinal	1%	-	Machnik et al., 2009
Semi-structured Interview + BDI II	N = 50 Canada swimming	Experimental design	68% pre competition 34% post competition	Associations with level of performance	Hammond et al., 2013*
GHQ (General Health Questionnaire)	n = 149 (current) n = 104 (former) International soccer players	cross-sectional retrospective	Current: 9% burnout 26% anxiety/ depression Former: 16% Burnout 39% anxiety/ depression	Associations with low social support and life events	Gouttebarge et al., 2015*
CES-D /ADS Cut-off = 16	N = 224 Australia Various disciplines	cross-sectional	26%	Differences across status of injury	Gulliver et al., 2015*
	N = 471 Swiss football players	cross-sectional	8% (Cut-off = 23: 3%)	Differences across gender	Junge & Feddermann-Demont, 2016*
	N = 465 USA Various disciplines	cross-sectional	26,5% Depression	Differences across sport discipline and gender	Wolanin et al., 2016*
CES-D adapted	N = 157 German female soccer players	Cross-sectional retrospective	32 % career-time prevalence	Differences across player’s position	Prinz et al., 2016*

Note. POMS (Profile of Mood States); CES-D (Center for Epidemiologic Studies Depression Scale); ADS (Allgemeine Depressionsskala); PAI (Personality Assessment Inventory); BDI II (Beck Depression Inventory II). * Labeled studies were added subsequently as they appeared after the conducted review in 2013. Table was modified with kind permission from: Frank, R., Nixdorf, I., & Beckmann, J. (2013). Depression among Elite Athletes: Prevalence and Psychological Factors. *Deutsche Zeitschrift für Sportmedizin, 64*, 320-326. Doi: 10.5960/dzsm.2013.088

Current research also often questions retired athletes on their current and former state of mental health (Gouttebarge, Kerkhoffs, & Lambert, 2015; Kerr et al., 2012; Prinz, Dvorak, & Junge, 2016). While this approach might offer useful information for estimation of potential risks of depression development caused by injuries during their career (Hutchison, Mainwaring, Comper, Richards, & Bisschop, 2009; Mainwaring et al., 2010), it also may introduce bias to the reported rates. Cognitive processes such as memory or attention can be biased or selective especially in potentially depressed persons (Everaert, Koster, & Derakshan, 2012; Krantz & Hammen, 1979). Therefore, athletes may not be able to accurately evaluate their career in retrospect. Nevertheless, those results also indicate rather high levels of depression, with over 30% of participating athletes reporting syndromes during their career (Gouttebarge, Frings-Dresen, et al., 2015; Prinz et al., 2016).

It has to be stated that after study 1 was complete, the studies subsequently added were not a result of a thorough systematic review of the literature as conducted in study 1. Therefore, other studies might be missing in this overview. Despite that, the added studies further relate to findings from study 1 and enhance overall understanding of this growing field of research. Also, newer reviews might be useful in the future to provide an integration with newer findings. In addition to prevalence rates, such reviews could systematically highlight the illustration of assessed factors and empirical support for certain hypotheses.

4.2 Burnout and depression

The second study addressed the relation between burnout and depression. The first result supported the general relationship of the two constructs, showing their cross-sectional correlation. More specifically, stress-related variables (chronic stress and recovery) appeared to account for a large degree of the association between burnout and depression. As previously suggested by the literature and conceptually assumed by our argumentation, this shows the importance of stress for mental disorders and psychological problems in elite athletes (De Francisco et al., 2016; Nixdorf et al., 2013).

However, stress and stressors might be further differentiated in this regard. In sports there are various possible sources of stress to be considered. Starting with the necessary physical stress induced by the training sessions, other factors to consider include perceived pressure to perform well, challenges regarding financial support, conflicts in

teams and training groups, or travel and organizational issues around the competition schedule (Anshel, 1996; Gould, Jackson, & Finch, 1993; Gustafsson, Hassmén, Kenttä, & Johansson, 2008; Hanton, Fletcher, & Coughlan, 2005). Recent research also found that stressors closely connected to the athlete's sport have a high relevance to depressive symptoms (Nixdorf et al., 2015). Thus, sport-specific knowledge of stress and stressors might elucidate the mechanisms behind stress-based conceptions of depression and burnout in athletes. De Francisco et al. (2016) also pointed out connections between stress, burnout and depression. However, more specific underlying mechanisms could be assumed and tested in longitudinal designs.

In regards to burnout and depression, the longitudinal CLPM analysis in study 2 revealed a temporal relation between the two constructs over time. Both constructs were relatively stable, but cross-paths were shown in both directions (depression to burnout and burnout to depression). Thus, shifts in symptomatology can be assumed in both directions and a clear, possibly linear relation is not supported. Models of burnout which indicate a process with depression in a late phase of this process (e.g. Gustafsson, Kenttä, Hassmén, Lundqvist, & Durand-Bush, 2007; Hallsten, 1993; Van Dierendonck, Schaufeli, & Buunk, 2001) might have to be reconsidered and other assumptions should also be empirically tested in this regard. As pointed out in the second study, dynamic processes or complex interactions might be considerable: for example the conservation of resources theory (COR; Hobfoll, 2001, 2011), where loss of resources in one domain may further exacerbate the depletion of resources in other domains. Furthermore, in the context of sport various resources and possible factors in this interplay should be considered.

As already demonstrated, stress appears to be an important factor in both burnout and depression. This in itself brings multiple challenges since stress is a wide research area in both fundamental and sport psychology, and now must be connected to mental health in general, and to depression and burnout athletes in particular. It is also possible to consider the previously-mentioned overtraining syndrome (Meeusen et al., 2013). Therefore research might address the relation between various constructs in a more detailed and specific manner. It seems necessary to distinguish and highlight overlaps and differences between interrelated constructs such as depression, overtraining and burnout. From a broad perspective all of these three syndromes appear to overlap: they all have a certain symptomatology which can be referred to as chronic stress reaction, including exhaustion and changes in the autonomous nervous system and the HPA axis (L. E. Armstrong & Van Heest, 2002; Varghese & Brown, 2001). On a conceptual level,

Lee et al. (2010) pointed this stress-relation out considering depression. In regards to burnout and overtraining, the common definition presumes that prolonged endurance of a stressor preceded the actual syndrome. In terms of burnout the stressor is occupational (Maslach, 2001) whereas in regards to the overtraining syndrome the stress is induced by extensive exercise stress (Meeusen et al., 2013). Although this reaction to prolonged stress seems comparable, there is a possibility to distinguish the syndromes by the location of the main stressor. Therefore, overtraining is specifically related to exercise stress, whereas burnout is sport-related in general; and depression does not presume a specific location at all, but stress can evolve from everywhere in life.

In other dimensions, there are further aspects by which these constructs might be distinguished. These may be in regards to performance, cognition, attitudes concerning the athlete's self-worth, or withdrawal behaviour. An overview is presented in table 3 highlighting some aspects to be considered in this regard. However, to further investigate this topic a more precise definition of burnout might be needed and hypotheses in regards to their temporal relation should be developed and tested.

Although seemingly relevant, assumptions of the interplay of various related constructs are often not stated. In current clinical sport psychology research, there is either one clinically relevant construct of main interest (S. Armstrong & Oomen-Early, 2009; Yang et al., 2007) or many clinical constructs are assessed without clear, underlying theoretical assumption between those constructs (Gulliver et al., 2015; Schaal et al., 2011). Further research might focus on specific mechanisms in regard to relevant syndromes among athletes. Following the results from study 2, simple models which assume overtraining as a first reaction is followed by burnout and eventually depression might fail to fully capture the complex interplay between these constructs. Thus, more complex models integrating different constructs are needed. The present overview on burnout, depression and overtraining should therefore indicate possible starting points for development of theoretical models to be tested in these regards.

Table 3

Relevant aspects in relating burnout to overtraining and depression in athletes

	Overtraining	Burnout	Depression
Symptomatology			
Symptoms resulting from chronic stress	✓	✓	✓
Exhaustion and fatigue	✓	✓	✓
Impact on cognition, attitudes and self-worth	- (overrating of decreased performance possible)	✓ Negative thinking on athletic aspects (performance, striving, value)	✓ Negative thinking; multiple aspects affected including self-worth
Withdrawal behaviour	-	✓ Sport devaluation	✓ In general including suicidal ideation
Performance impairment	✓ Per definition	(✓) mostly subjective (reduced sense of accomplishment)	- (symptoms may affect performance)
Conceptual aspects			
Stress relation	✓	✓	✓
Location of stressor	Physical; training stress	In sports; mental and physical stress	Stress of all kinds (also Sports-unrelated)
Dysfunctional attitudes; perfectionism	- (possible associations)	(✓) (with adaptive and maladaptive side)	✓ Dysfunctional vulnerability

4.3 Conclusion

Psychological disorders are common in athletes. Study 1 points this out and summarizes overall findings in regards to depression, which can be severe in some circumstances. However, based on the perceived role and image of elite athletes (Biskup & Pfister, 1999; Stephan & Brewer, 2007), it appears that the basic, first step is to acknowledge this rather trivial statement. And acknowledgement should be developed on every level, which includes sport psychological researchers, supporters, society and athletes themselves. There is little need for further results which illustrate the severity of depression in athletes, little need for shocking media reports on suicidal behaviour of athletes, and little need for supporters and athletes to ignore and hide the problem of psychological challenges in sports. Athletes are human beings with the full range of characteristics humanity has to offer, including psychological disorders. Once this is acknowledged, it might help research and practice face the more important challenges of helping suffering athletes.

In order to face these challenges, research should investigate the mechanisms of stress-related conditions in athletes, assess important factors for their development, and improve understanding of the syndromes and their aetiology in sports. This understanding might in turn lead to knowledge which may help with disease prevention and improvement of support structures. Study 2 pointed out general associations and supported the importance of stress-related factors in this regard. It was also shown that processes and interactions between important factors in this regard might be complex and further research is needed in order to understand these mechanisms.

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6 Attachments

6.1 List of publications

Frank, R., Nixdorf, I., & Beckmann, J. (in press). Analyzing the relationship between depression and burnout in junior elite athletes. *Journal of Clinical Sport Psychology*.

Frank, R., Nixdorf, I., & Beckmann, J. (in press). Stress, under-recovery and health problems in athletes. In M. Kellmann & J. Beckmann (Eds.), *Recovery and performance.* Abingdon: Routledge.

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Nixdorf, I., Frank, R. & Beckmann, J. (2015). An explorative study on major stressors and its connection to depression and chronic stress among German elite athletes. *Advances in Physical Education*, 5, 255-262.

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Frank, R. & Nixdorf, I. (2013). Depressive Syndrome - Wenn Hochleistungssportler an ihre Grenzen stoßen. *DNP - Der Neurologe und Psychiater, 14*(2), 58-60.

Frank, R., Nixdorf, I., & Beckmann, J. (2013). Depression im Hochleistungssport: Prävalenzen und psychologischen Einflüssen. *Deutsche Zeitschrift für Sportmedizin, 64*(11), 320-326.

Nixdorf, I., Frank, R., Hautzinger, M., & Beckmann, J. (2013). Prevalence of depressive symptoms and correlating variables among German elite athletes. *Journal of Clinical Sport Psychology, 7*(4), 313-326.

6.2 Journals permissions

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Univ. Prof. Dr. med. Dr. h.c. Jürgen M. Steinacker
Sektion Sport- und Rehabilitationsmedizin
Universitätsklinikum Ulm
Leimgrubenweg 14
89075 Ulm, Germany

Telefon: (+49)731-500-45300
Telefax: (+49)731-500-45303

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Frank, Raphael

Von:	Donald Marks <domarks@kean.edu>
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Hi Raphael,

Please accept this email as confirmation that the *Journal of Clinical Sport Psychology* permits inclusion of your accepted manuscript entitled, "Analyzing the Relationship between Burnout and Depression in Junior Elite Athletes," in your Ph.D. thesis document.

Thank you for your contributions to our publication and please accept our congratulations on the completion of your doctoral thesis.

Please do not hesitate to let me or Kendahl know if you have need any additional documentation or information regarding this matter.

Best regards,

Don Marks
Editor-in-Chief
Journal of Clinical Sport Psychology

--
Donald R. Marks, Psy.D.
Assistant Professor
Director of Clinical Training, Psy.D. Program
Director, Kean Psychological Services
Advanced Studies in Psychology
Nathan Weiss Graduate College
Kean University
Phone: 908-737-5882
Email: domarks@kean.edu

[Seite]

6.3 Publication study 1 in German language

Frank R, Nixdorf I, Beckmann J

Depressionen im Hochleistungssport: Prävalenzen und psychologische Einflüsse

Depression in Elite Athletes: Prevalence and Psychological Factors

Lehrstuhl für Sportpsychologie , Technische Universität München

ZUSAMMENFASSUNG

Depressionen im deutschen Hochleistungssport stehen immer mehr im Fokus des öffentlichen und medialen Interesses. Interessanterweise sind aber nur wenige empirische Daten über die Thematik vorhanden. Weder repräsentative Prävalenzraten noch zugrundliegende Entstehungsmechanismen dieser Krankheit in einer Population von Hochleistungssportlern sind empirisch abgesichert. Die folgende Übersichtsarbeit fasst den aktuellen wissenschaftlichen Stand zusammen, versucht erste Einblicke in mögliche Zusammenhangsfaktoren zu bieten und widmet sich der Frage, ob Depressionen im deutschen Hochleistungssport besonders vertreten sind. Eine Auswertung der aktuellen Studien zu diesem Thema soll erste Erkenntnisse sowie Forschungslücken kritisch darstellen. Erste Untersuchungen im deutschsprachigen Raum deuten darauf hin, dass depressive Symptomatik im Spitzensport mindestens so ausgeprägt ist wie in der deutschen Bevölkerung. Aufgrund der immer noch zu geringen Anzahl und Qualität an Studien lassen sich allerdings keine empirisch gesicherten Zahlen finden. Hierfür fehlen repräsentative Studien mit klinischen Beurteilungskriterien. Als für den Sport relevante Faktoren haben sich bisher chronischer Stress, Stressverarbeitungsstrategien und die Balance zwischen Erholung und Belastung aufdecken lassen. Dabei scheint auch die sportspezifische körperliche Belastung eine wesentliche Rolle zu spielen. Auch lassen sich vage Hinweise auf soziale Faktoren, wie etwa der Mannschaftszusammenhalt und individuelle Faktoren (z.B. Perfektionismus) finden. Die Studienlage ist hier allerdings noch zu gering, um Aussagen über Relevanz und Wirkung dieser Themen treffen zu können. Weitere Forschung könnte vor allem durch die Untersuchung von Faktoren im Hinblick auf kausale und theoriegeleitete Hypothesen einen Mehrwert darstellen.

Schlüsselwörter: Depression, Hochleistungssport, Verbreitung, Stress, Coping, Erholung

SUMMARY

Depression among elite athletes has raised public awareness. Interestingly, empirical data on the issue are rare. Neither representative prevalence rates nor insights into the special mechanisms leading to depressionin the field of elite athletes are known in detail. The following work reviews the current state of research trying to get a first summary in what is known about underlying mechanisms leading to depression and trying to answer the question whether or not depression are widespread among German elite athletes. By analyzing the current studies in this field, the present article provides a scientific overview of first findings and academic voids. Initial studies on German elite athletes point out that the prevalence for depressive symptomatology in elite athletes is comparable to the general German population. Due to the small number and quality of studies there are no representative data. Therefore, future studies using clinical criteria of assessing depressive episodes are needed. Associated factors in competitive sports are high levels of chronic stress, coping strategies, and the balance of physical and psychological stress and recovery. Therefore, the sport specific physical stress seems to play an important role. There are uncertain hints for social factors, such as team cohesion, and individual factors (e.g. perfectionism). However, there are insufficient studies to draw statements about relevance or effect of these topics. Further studies could gain scientific evidence by examining the causality and theory driven hypotheses of these factors.

Key Words: depression, elite athletes, prevalence, stress, coping, recovery

EINLEITUNG

Berichte über Athleten, die unter einer psychischen Krankheit leiden, häufen sich. Bislang wurde das Thema weitestgehend tabuisiert. Dementsprechend stecken Ansätze einer Klinischen Psychologie innerhalb des Sports bislang noch in den Kinderschuhen. Das Thema der Gesundheit im Spitzensport scheint häufig nur im Sinne einer physischen Funktionstüchtigkeit betrachtet zu werden. Das Auftreten psychischer Krankheiten wird im Spitzensport noch nicht allgemein wahrgenommen und unterliegt häufig einer starken Stigmatisierung (36). Für eine Prävalenz im Leistungssport, sofern überhaupt differenziert betrachtet, sind verschiedene Argumentationsrichtungen zu finden. Dass Spitzenathleten aufgrund ihrer besonderen Stellung in der Gesellschaft, des enormen Leistungsdrucks und des hohen Pensums an Stress besonders vulnerabel für die Entstehung von depressiver Symptomatik sind, wird ebenso vertreten, wie die Meinung, dass Athleten besonders resiliente und wenig vulnerable Persönlichkeiten seien. Hoyer & Kleinert (19) geben einen ersten, allgemeinen Überblick über die verschiedenen Sichtweisen und die Rolle psychischer Krankheiten im Leistungssport. Im Folgenden wollen wir jedoch spezifisch auf den Bereich der Depression fokussieren und weiterführend vorliegende, empirische Erkenntnisse in einer wissenschaftlichen Über-

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Frank R, Nixdorf I, Beckmann J: Depressionen im Hochleistungssport: Prävalenzen und psychologische Einflüsse. Dtsch Z Sportmed 64 (2013) 320 - 326.

Tabelle1: Übersicht über die inkludierten Studien im Hinblick auf Stichprobe, Methodik, Ergebnisse zur Prävalenz und untersuchten Faktoren mit Bezug zu Depressivität.

Erfassung Depressivität	Stichprobe Athleten	Design	Prävalenz, gerundet	Erhobene Faktoren mit Bezug zu Depressivität	Studie
Experten-Interview	N = 2 067	Querschnitt zur Erfassung der Prävalenz	Letzte 6 Monate: 4%	Unterschiede nach Sportart und Geschlecht,	Schaal et al., 2011
	Repräsentative Stichprobe Frankreich		Lebenszeit: 11%	weitere Klinische Störungen	
	Sportarten nicht bekannt				
ADS	N = 162 (99 Profi; 35 Nachwuchs)	Querschnitt; korrelative online Studie	Profis: 15%	Chronischer Stress,	Nixdorf et al., in press*
Cut-off = 23	Deutsche Athleten		Nachwuchs: 20%	Coping,	
	18 Sportarten			Erholung & Belastung	
CES-D	N = 257	Querschnitt, Korrelative Studie	21%	State und trait anxiety	Yang et al., 2007
Cut-off = 16	College, USA		(Cut-off = 23: 6%)	„Freshman“	
	13 Sport-mannschaften				
	N = 66	Querschnitt, Vergleich Athleten vs. Nicht-Athleten	16%	Coping	Proctor & Boan-Lenzo, 2010
	College, USA				
	Baseballspieler				
	N = 104 (Athleten)	Querschnitt, Korrelative Studie	33.5%	Selbstwert,	Armstrong & Oomen-Early, 2009
	College, USA			Soziale Eingebundenheit,	
	Sportarten nicht bekannt			Schlaf	
PAI	N = 105 (Athleten)	Querschnitt, Vergleich Athleten vs. Nicht-Athleten	Frauen: 10%	Soziale Angst,	Storch et al., 2005
Cut-off = 32	College, USA		Männer: 4%	Alkoholprobleme,	
	Fuß-, Volley-, Basket- und Football, Tennis, Schwimmen			Empfundene Soziale Unterstützung	
				Unterschied zwischen Geschlecht	
einzelne Frage zu "Melanchonlie, Depression, Unglücklichsein"	N = 723	Querschnitt	2-4% (mehrmals die Woche)		Thiel et al., 2010*
	Deutsche Athleten				
	Handball, Leichtathletik				
Selbst-einschätzung; Antwortformat: „ehrlich Ja“, „ehrlich Nein“, „Keine Antwort“	N = 1 154	Querschnitt, Online Befragung Randomised Response Technique	9%		Breuer & Hallmann, 2013*
	Deutsche Athleten				
	Sportarten nicht bekannt				
Positive Testung auf Antidepressiva	N = 82 880	Querschnitt und Verlauf über mehrere Jahre	1%		Machnik et al., 2009
	50 Nationen				
	178 Sportarten				

Bemerkung: POMS (Profile of Mood States); CES-D (Center for Epidemiologic Studies Depression Scale, 32); ADS (Allgemeine Depressionsskala, 14); PAI (Personality Assessment Inventory, 25). * Die gekennzeichneten Studien wurden nachträglich hinzugefügt und nicht bei der Datenbankrecherche identifiziert. Die Reihenfolge der Studien erfolgte nach der Qualität des Erhebungsmaßes der Depressivität.

sicht zu diesem Krankheitsbild zusammenfassen. Dabei sollen Erkenntnisse über Prävalenzen, mögliche Determinanten bei der Entstehung und daraus resultierende Forschungslücken kritisch dargestellt werden.

METHODE

Zur Identifizierung der vorhandenen Forschungsergebnisse wurden die Datenbanken PubMed, MEDLINE, PsycINFO, PSYNDEX und The Cochrane Library herangezogen. Die Suchbegriffe waren wie folgend in deutscher Sprache: Depression & Sport, depressive Stimmung & Leistungssport, depressive Symptomatik &Leistungssport und Depression & Leistungssport und in englischer Sprache: depression & athlete(s), depressive mood & athlete(s), depressive symptoms & athlete(s) und depression & sport(s). Es wurde kein Ausschluss anhand des Publikationsdatums vorgenommen. Die Suchergebnisse wurden geprüft hinsichtlich ihrer Passung in den Kriterien: Empirische Studie, Stichprobe im Hochleistungssport und Erhebung der Depressivität als abhängige Variable. Hier konnten sechs Studien (siehe Tab. 1) identifiziert werden.Im Anschluss wurden die Literaturangaben hinsichtlich weiterer Artikel untersucht, die bei der ursprünglichen Recherche nicht identifiziert wurden und einen Mehrwert für den vorliegenden Überblick bieten konnten. Weitere drei relevante Artikel wurden, sofern bekannt und den beschriebenen Kriterien entsprechend, mit einbezogen. Tabelle 1 gibt eine Übersicht über alle inkludierten Studien. Ausgeschlossen wurden jene Artikel, die sich ausschließlich mit einer reaktiven Depression auf Verletzungen hin beziehen. Artikel zur Thematik Burnout wurden bei der Suche aufgrund der noch nicht hinreichend geklärten Definition sowie Beziehung zu depressiven Syndromen nicht mit eingeschlossen.

Zur Darstellung der berichteten Prävalenzen wurden die Artikel hinsichtlich dieser Daten durchsucht. Im zweiten Schritt wurden die Studien auf weitere untersuchte Faktoren durchleuchtet. Die folgende Darstellung der Ergebnisse gliedert sich nach diesem Vorgehen, wobei die Darstellung der Prävalenzen nach Herkunft der Stichprobe und die untersuchten Faktoren nach Themengebiet aufgegliedert wurden.

VERBREITUNG DEPRESSIVER SYMPTOMATIK

Epidemiologische Zahlen der Allgemeinbevölkerung aus Deutschland

Betrachtet man die deutsche Allgemeinbevölkerung, so sind depressive Störungen weit verbreitet. Die Lebenszeitprävalenz für depressive Störungen liegt bei 17% (42,20). Die Prävalenz für 12 Monate liegt bei 11% und die 4-Wochen Punktprävalenz bei 6% (20). Dabei sind Frauen mit einer Lebenszeitprävalenz von 25% deutlich stärker betroffen als Männer mit einer Lebenszeitprävalenz von 12%.

Internationale Untersuchungen im Leistungssport

Die meisten Arbeiten zu depressiver Symptomatik im Spitzensport stammen aus dem US-amerikanischen Raum, zumeist aus dem Bereich des Collegesports. Yang et al. (43) untersuchten 257 Athleten und fanden in dieser Population eine Prävalenz von 21%, bezogen auf das Vorhandensein depressiver Syndrome. Es ist zu erwähnen, dass hier zur Erfassung eines depressiven Syndroms anhand der weit verbreiteten und gut validierten CES-D (32) der geringere cut-off von 16 Punkten verwendet wurde, was die relativ hohen Prävalenzen erklären mag. Armstrong und Oomen-Early (2) berichten in ihrer Studie eine Prävalenz von 33,5%, erfasst anhand desselben cut-off. In dieser Untersuchung litten die Sportler signifikant weniger an depressiven Symptomen als die Nicht-Sportler. Auch Proctor und Boan-Lenzo (29) verwendeten denselben cut-off und berichten in ihrer Studie von geringeren Prävalenzen bei Sportstudenten als bei den Studierenden anderer Fächer. Weitere vergleichende Studien, wie zum Beispiel von Storch, Storch, Killiany und Roberti , bestätigen diesen Unterschied allerdings nicht (38). In dieser Studie wurde ein allgemeines, klinisches Erhebungsinstrument (PAI) (25) verwendet mit einem konservativen cut-off von 32 Punkten, wobei die Prävalenzen eher gering waren und sich Sportler von Nicht-Sportlern nicht signifikant unterschieden. Bei den Sportlern dieser Untersuchung lagen die Prävalenzen zwischen 10% (Frauen) und 4% (Männer).

Zusammenfassend kann man sagen, dass die Ergebnisse (siehe Tab. 1) der wenigen vorliegenden Studien hinsichtlich des Themas der Prävalenz von depressiven Syndromen unter Sportlern an amerikanischen Colleges insgesamt widersprüchlich sind und nicht an Spitzensportlern durchgeführt wurden. Schaal et al. (34) führten in Frankreich eine repräsentative Studie zu psychischen Problemen im Spitzensport durch. Die Ergebnisse zeigen, dass rund 4% der Athleten eine akute depressive Episode aufwiesen. Die Lebenszeitprävalenz lag in dieser Studie bei 11%, wobei das Vorliegen einer depressiven Episode anhand eines Experteninterviews festgestellt wurde.

UNTERSUCHUNGEN IM DEUTSCHEN HOCHLEISTUNGSSPORT

Wenngleich die genannten Untersuchungen grundsätzlich von Interesse hinsichtlich der Frage eines Zusammenhangs von Sport und depressiver Symptomatiksind, ist eine Übertragbarkeit der Prävalenzen auf den deutschen Spitzensport nicht möglich. Die verschiedenen Systeme (College vs. Kader), wie auch die selektiven Stichproben (ausschließlich Studierende) und mögliche kulturelle Unterschiede zwischen den Probanden, lassen eine Übertragung nicht zu.

Im deutschen Forschungsraum untersuchten Thiel, Mayer und Digel (40) eine Stichprobe von Handballern und Leichtathleten (1. und 2. Bundesliga und A-, B-, C- und D-Kader) und fanden, dass 2–4% der Sportler mehrmals pro Woche Melancholie, Depression oder Unglücklichsein verspürten. Klinisch gesehen sind diese Ergebnisse, aufgrund fehlender diagnostischer Verfahren, wie zum Beispiel einem klinischen Interview oder validierten Fragebögen, jedoch nicht aussagekräftig und können somit auch keinen konkreten Hinweis auf Prävalenzraten für Depressionen liefern. Auch die Prävalenz von 0,6% für Antidepressiva, welche bei auf Doping getesteten Sportlern gefunden wurde (23), sagt wenig über unter depressiver Symptomatik oder Depression leidende Sportler aus. Es kann nicht auf das Vorhandensein einer depressiven Störung geschlossen werden, da nicht alle depressiven Erkrankungen (mit Antidepressiva) behandelt werden und Antidepressiva auch für andere Indikationen verordnet werden. Die Studie von Machnik et al. (23) fand allerdings einen relativ starken Anstieg der Nachweise von Antidepressiva in Dopingkontrollen seit 2006.

Die erste Untersuchung, die sich direkt mit der Verbreitung von depressiven Syndromen im deutschen Spitzensport befasst, ist die Studie von Nixdorf, Frank, Hautzinger und Beckmann (27). Anhand eines klinischen, validen Fragebogens (ADS, deutsche Version der CES-D) (14) wurde hier für die 99 untersuchten Hochleistungssportler eine Prävalenz von 15 %, für die 35 Nachwuchsprofis eine Prävalenz von 20%, für das Vorhandensein von depressiven Syndromen ermittelt. Der cut-off wurde in dieser Studie bei 23 Punkten sehr konservativ gesetzt, wodurch kurzzeitige Symptomerscheinungen oder Erschöpfungszustände aufgrund der sportlichen Belastung besser abgegrenzt werden können. Im Vergleich mit der Normierungsstichprobe aus der Normalbevölkerung der ADS, hier wurde für Männer eine Prävalenz von 12% und für Frauen eine Prävalenz von 16% ermittelt, sind die gefundenen Ergebnisse vergleichsweise annähernd. In einer Studie anhand der *randomized response technique* von Breuer und Hallmann (3) gaben 9% der 1154 befragten Athleten an, an einer depressiven Erkrankung zu leiden. Gleichzeitig gaben 50% an, nicht an einer depressiven Erkrankung zu leiden und 41% gaben keine Antwort zu dieser Frage. Die Erkenntnisse anhand dieses 3-stufigen Antwortformates sind, aufgrund der hohen Anzahl an Enthaltungen und dem hohen subjektiven Anteil, was die Athleten als depressive Erkrankung einstufen, aus klinisch-symptomatischer Sicht allerdings wenig aussagekräftig.

DISKUSSION ZUR VERBREITUNG DEPRESSIVER SYMPTOMATIK

Der Kenntnisstand zu Verbreitung und Ausprägung depressiver Symptomatik im deutschen Leistungssport ist momentan als unzureichend zu bezeichnen. Wie Tabelle 1 verdeutlicht, werden oftmals keine validen Erhebungsmaße verwendet. Unterschiedliche cut-off Werte erschweren den Vergleich zwischen den Studien und lassen bei wenig konservativen cut-off Werten Prävalenzen teilweise recht hoch erscheinen. Die einzige deutsche Erhebung der Prävalenz mit einem validierten Fragebogen weist darauf hin, dass es im Spitzensport allgemein eine vergleichbare Ausprägung von depressiven Syndromen,wie in der deutschen Bevölkerung geben könnte (27). Die Stichprobe ist jedoch nicht repräsentativ für die Grundgesamtheit des Leistungssports und deckt nicht das gesamte Spektrum der Sportarten ab. Darüber hinaus ist nicht ersichtlich, ob nicht Überschneidungen in der Stichprobe zwischen den einzelnen Studien existieren. Des Weiteren existieren im deutschen Spitzensport keine Daten über klinisch diagnostizierte depressive Episoden.

Auch Unterschiede in der Verbreitung depressiver Symptomatik zwischen Männern und Frauen, wie sie in der Normalbevölkerung zu finden sind, bleiben bisher Spekulation. Während Storch et al. (38) in ihrer Untersuchung einen Unterschied feststellen konnten, indem weibliche Collegestudenten stärker betroffen sind als ihre männlichen Kollegen, konnten Nixdorf et al. (27) einen solchen Unterschied zwischen den Geschlechtern im deutschen Hochleistungssport nicht feststellen. Interessanterweise wurden hier allerdings Unterschiede in der Ausprägung der Depressivität zwischen Teamsportlern und Individualsportlern ermittelt, welche sich auch in Frankreich aufzeigen ließen (34). Individualsportler zeigten sich dabei stärker betroffen von depressiven Symptomen als Mannschaftssportler. Dies deutet darauf hin, dass es im Spitzensport besondere Gesetzmäßigkeiten geben könnte und die Erkenntnisse aus der Normalbevölkerung nicht vorbehaltlos auf die Population des Leistungssports zu übertragen sind. Um solche Einflüsse genauer zu betrachten,werden im Folgenden die bisherigen Erkenntnisse möglicher Determinanten dargestellt.

MÖGLICHE DETERMINANTEN VON DEPRESSIONEN IM HOCHLEISTUNGSSPORT

Generell ist bei der Entstehung von depressiven Störungen von einem multifaktoriellen Bedingungsmodell auszugehen (42). Dabei können biologische (z.B. Genetik), psychologische (z.B. kognitive Defizite) und soziale (z.B. Konflikte) Faktoren zum Auftreten einer depressiven Erkrankung beitragen. Wenn man einen näheren Blick auf die Struktur im Hochleistungssport und die Anforderungen an die Athleten wirft, so lassen sich Faktoren identifizieren, die im Zusammenhang mit dem Auftreten von depressiver Symptomatik stehen können. Im Folgenden werden die nach bisherigem Wissenstand relevanten Themen im Hinblick auf ihren Zusammenhang mit depressiver Symptomatik im Spitzensport dargestellt.

Stress

Immer wieder wird der enorme psychische Stress erwähnt, dem die Athleten tagtäglich ausgesetzt sind (31). Die verschiedenen Stressoren variieren dabei von trainings- und wettkampfbezogenen Anforderungen (z.B. ein verlorener Wettkampf, Kosten und Aufwand des Trainings) hin zu alltäglichen Stressoren. Eine wachsende Anzahl von Studien weist darauf hin, dass für Athleten sowohl wettkampfbezogene, wie auch davon unabhängige, alltägliche Stressoren, die über das Sportereignis hinausgehen, zentrale Belastungen darstellen. So nennen zum Beispiel Eiskunstläufer, Golfer und Tennisspieler als häufige Stressoren: Besorgnis bezüglich des eigenen Leistungspotentials, einen verlorenen Wettkampf und damit einhergehende Versagensängste und Unzufriedenheit, Konflikte mit Trainern, Partnern oder Familien, Kosten und Aufwand des Trainings sowie physische Anforderungen (8,12,33,30).

Der Zusammenhang zwischen Stress und psychischen Störungen, insbesondere zwischen Stress und Depressionen, ist empirisch anerkannt (13,22,24). Inzwischen wurden diese Erkenntnisse auf den Hochleistungssport übertragen und auch hier ein Zusammenhang zwischen chronischem Stress und depressiver Symptomatik gefunden (27). Inwieweit auch akuter, wettkampfbezogener Stress sich negativ auswirken kann bleibt bisher offen.

Coping

Individuelle Unterschiede spielen im Umgang mit Belastungen eine wichtige Rolle. Die oben genannten Stressoren werden nicht von allen Sportlern gleichermaßen negativ wahrgenommen.Von großer Bedeutung sind hier vor allem die Stressverarbeitungsstrategien des einzelnen Athleten. Strategien zur Bewältigung von Stress oder belastenden Ereignissen werden häufig unter dem englischsprachigen Begriff des Coping subsumiert. Es handelt sich dabei um eine Bezeichnung für eine Vielzahl von Strategien und Verhaltensweisen in der Auseinandersetzung mit Stressoren und belastenden Situationen (35).

Studien in der Normalbevölkerung konnten zum Vergleich des Copingverhaltens von gesunden und klinisch auffälligen Populationen einen signifikanten Unterschied in der Anwendung einzelner

Strategien finden (vgl. 41). Wingenfeld et al. (41) berichten, dass klinische Patienten, die an Depressionen leiden, signifikant mehr emotionsbezogenes Coping (z.B. Selbstbemitleidung) anwenden als Kontrollgruppen. Emotionsbezogene Copingstrategien korrelieren laut den Autoren positiv und problemorientierte Copingstrategien (z.B. Reaktionskontrolle) negativ mit psychopathologischen Erkrankungen, wie zum Beispiel Depression.

Des Weiteren konnten Studien aufzeigen, dass sich Copingstrategien zwischen den Geschlechtern unterscheiden (9, 18, 11). Nicholls et al. (26) haben Unterschiede in der Häufigkeit und Art der Copingstrategien auch für verschiedene Sportarten, sowie Individual- bzw. Mannschaftssportarten finden können. Erste Anzeichen auf den Zusammenhang zwischen Copingstrategien und depressiver Symptomatik unter Hochleistungssportlern zeigen Befunde an deutschen und amerikanischen Athleten(27,29). Die Untersuchungen fanden insbesondere einen positiven Zusammenhang zwischen depressiver Symptomatik und negativen, emotionsbezogenen Copingstrategien.

Trainingsbelastung

Ebenfalls besondere Relevanz scheint der Zusammenhang zwischen enormer physischer Belastung und negativer Stimmung zu haben. Physische Belastungen sind essentielle Voraussetzungen für Sportler, um ihre Leistung zu steigern. Besteht allerdings über längere Zeit ein Missverhältnis zwischen Belastung und Erholung, kann dies zu einem Überlastungssyndrom führen, das als Übertraining bezeichnet wird (37). Bessert sich dieser Zustand trotz einer mindestens 2 Wochen dauernden Erholungsphase nicht, spricht man vom Syndrom des Übertrainings (4). Dieser chronifizierte Zustand äußert sich, neben dem erwähnten Leistungseinbruch, durch Symptome wie Müdigkeit, Gewichts- und Appetitverlust, Schlafstörungen, emotionale Labilität sowie Angst, depressive Verstimmung, Schweißausbrüche, schwere Muskeln und häufige, kleine Infektionen (4,5,6,7).

Bei näherer Betrachtung dieser Symptome werden starke Ähnlichkeiten zur depressiven Symptomatik deutlich. Armstrong und VanHeest (1) weisen darauf hin, dass große Überlappungen in der Symptomatik existieren (z.B. Appetit-, Gewichtsverlust, Schlafprobleme oder Energielosigkeit). Ferner berichten die Autoren von vergleichbaren Änderungen im vegetativen Nervensystem und der beteiligten Neurotransmitter. Sie schließen daraus, dass Übertraining einer ähnlichen Ätiologie wie Depression unterliegen mag. Auch Puffer und McShane (31) weisen auf einen Zusammenhang zwischen Übertraining und Depression hin. Nach Meinung der Autoren können Depressionen auch ohne körperliche Erschöpfung auftreten, sind jedoch weit häufiger bei Sportlern mit körperlicher Erschöpfung. Konkrete Studien deuten ebenfalls in diese Richtung, wie zum Beispiel O'Conner, Morgan, Raglin, Barksdale und Kalin (28), die einen signifikanten Zusammenhang zwischen einem stark erhöhten Trainingspensum bei Schwimmern und deren depressiver Stimmung zeigen konnten. Auch in Deutschland fand man einen starken Zusammenhang zwischen der Balance von Erholung und Belastung und depressiver Symptomatik (27). Es zeigte sich deutlich, dass Athleten mit starker Belastung bei geringer Erholung stärker von depressiven Symptomen betroffen sind, als erholte Kollegen. Gerade aus der Forschung im Bereich Übertraining weiß man um die Bedeutung von physiologischen Veränderungen (z.B. über die Hormone Leptin und Insulin oder über Zytokine) und ihren Einfluss auf zentralnervöse Prozesse im Hypothalamus durch überdauernde Trainingsbelastungen (37). Diese Veränderungen können sich wiederum in auch psychologisch sichtbaren Merkmalen wie der Stimmung oder Erschöpfungsgefühlen widerspiegeln. Neben der rein physiologischen Belastung scheint hier auch eine Interaktion mit psychologischen Einflüssen (z.B. Freizeitgestaltung) möglich (21). Zu klären bleiben hier allerdings noch die genauen Hintergründe und Mechanismen dieser Zusammenhänge und Interaktionen.

Individuelle und soziale Einflussgrößen

Neben den bereits dargestellten Faktoren lassen sich weitere Einflüsse finden, die möglicherweise eine Relevanz im Leistungssport besitzen. Zu nennen sind hier bestimmte Persönlichkeitseigenschaften von Sportlern, die einen Einfluss auf Depressivität haben können. Studien in der Normalbevölkerung konnten eine perfektionistischePersönlichkeit mit einer erhöhten Vulnerabilität für das Auftreten von Depressionen in Zusammenhang bringen (15,16). Empirische Evidenz für diese im Hochleistungssport naheliegenden Erkenntnisse steht allerdings noch aus. Hinweise existieren hier bisher nur für einen Zusammenhang zwischen Burnout und perfektionistischen Einstellungen (17).

Ebenfalls einflussreich könnten soziale Aspekte wie etwa die Gruppenkohäsion in Mannschaften und Trainingsgruppen, das damit verbundene soziale Umfeld von Betreuern, Managern, Beratern oder auch Trainern, sowie soziale Fähigkeiten und Kompetenzen der einzelnen Sportler sein. Die Befunde über amerikanische Collegeathleten weisen solche sozialen Aspekte auf, wonach ein Zusammengehörigkeitsgefühl mit geringerer Depressivität verbunden ist (2,38). Die Erkenntnisse beziehen sich hier allerdings sowohl auf Athleten wie auch auf normale Studierende. Im Spitzensport selbst gibt es korrelative Befunde (39), die als Hinweise auf ähnliche, mögliche Einflussfaktoren für depressive Syndrome dienen können.

FAZIT

Aus den vorliegenden Erkenntnissen lässt sich ableiten, dass die Thematik der Depressionen im Hochleistungssport nicht nur eine durch die Medien erzeugte Debatte darstellt, sondern mittlerweile auch empirische Zahlen die Relevanz dieses Themas verdeutlichen. Allerdings sind noch immer zu wenige Studien vorhanden, um repräsentative Aussagen treffen zu können. Vor allem Studien mit klinischen Kriterien zur Prävalenzerfassung sind kaum vorhanden. Hierfür sollte eine Diagnose durch einen Psychologischen Psychotherapeuten oder einen Psychiater gestellt werden. Weitere Forschung, die ein klares diagnostisches Urteil anhand der ICD-10 (10) Kriterien ermöglicht und eine repräsentative Grundgesamtheit in verschiedensten Sportarten erhebt, ist nötig, um verlässliche Zahlen zu liefern. Auf eine möglichst detaillierte Angabe der untersuchten Stichprobe sollte dabei geachtet werden, um mögliche Überschneidungen und die Repräsentativität der Probanden beurteilen zu können.

Des Weiteren scheint die Ausprägung der depressiven Symptomatik und deren zugrundeliegenden Determinanten nicht analog von der Normalbevölkerung auf die Population des Hochleistungssports übertragbar zu sein. Besondere Einflüsse, wie zum Beispiel die Trainingsbelastung, sportspezifische Stressoren oder Unterschiede je nach Sportart, scheinen spezielle Berücksichtigung bei der Erforschung zu verlangen. Infolge dessen sollten Erkenntnisse

aus der Depressionsforschung zwar genutzt, allerdings erst durch empirische Studien im Hochleistungssport untersucht werden. Zudem sollten sportspezifische Faktoren (z.B. Stressoren, körperliche Belastungen etc.) berücksichtigt werden. Erste assoziierte Faktoren konnten bereits identifiziert werden. Diese sind: Der chronische Stress, dem Sportler teilweise in hohem Maße ausgesetzt sein können; Stressverarbeitungsstrategien, welche besonders präventiv eine wichtige Rolle spielen können und eine Dysbalance zwischen Erholung und Belastung in sowohl sportlichen wie auch allgemeinen Bereichen. Studien zu genauen Zusammenhängen, wie auch Abgrenzungen zu Themen wie dem Übertraining, könnten hier weiterführende Erkenntnisse liefern.

Um weiterführende Erkenntnisse z.B. für Präventionsprogramme zu gewinnen, sollten insbesondere Wirkfaktoren näher untersucht werden. Hierfür sind vor allem längsschnittliche Untersuchungen nötig, um kausale Zusammenhänge besser nachvollziehen zu können. Die bisherigen Erkenntnisse lassen lediglich Hypothesen über Wirkmechanismen zu, die erst in entsprechendem Studiendesign untersucht werden sollten. Die bisherigen, eher explorativen Studien könnten in Zukunft durch stärker theorie- und hypothesengeleitetes Vorgehen klarere Evidenz liefern. Zudem ist die Erfassung von depressiver Symptomatik durch valide Messinstrumente für solch weiterführende Forschung über Entstehungsfaktoren wichtig, um konkrete Aussagen über depressive Syndrome und deren Zusammenhänge treffen zu können. Dabei ist ein reger Austausch zwischen Forschern und den Verbänden, Vereinen und Betreuern besonders wichtig. Die Bereitschaft, dieses Thema wissenschaftlich konstruktiv zu erfassen, ist eine wichtige Voraussetzung für weitere Erkenntnisse.

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Korrespondenzadresse:
Dipl.-Psych. Raphael Frank
Technische Universität München
Lehrstuhl für Sportpsychologie
Georg-Brauchle-Ring 60/62
80992 München
E-Mail: raphael.frank@tum.de