

Risk profiles for athlete burnout in adolescent elite athletes: A classification analysis

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ABSTRACT

Objectives: All adolescent elite athletes are subjected to extensive additional stressors compared to their age-mates, but only some show symptoms of athlete burnout (ABO). In this study, we aim to decipher which features characterize adolescent elite athletes with especially high and low ABO symptomatology.

Methods and design: We used data from the GOAL study (“German Young Olympic Athletes’ Lifestyle and Health Management Study”) in which 1138 young elite athletes ($M = 16.33$ years, $SD = 1.10$) were assessed regarding ABO symptomatology (via the ABQ) and several correlate features. Cross-sectional data were analysed via Classification Tree Analysis in order to identify and characterize groups with extreme levels of ABO symptomatology.

Results: Results indicate different relevant correlates for each of the three burnout symptoms. Comprehensive analyses revealed specific combinations of high and low-risk characteristics. High-risk characteristics included being involved in a technical, endurance, aesthetic or weight-dependent sport, training under an autocratic or laissez-faire coach, high subjective stress outside of sport, a low willingness to make psychological sacrifices, lack of sleep, and being female. Low-risk characteristics included fewer hours of training, low social pressure, low subjective stress outside of sport, a high willingness to make psychological sacrifices, and a high health satisfaction.

Conclusion: Our results provide a necessary base for future hypothesis-testing studies in the field of adolescent ABO, as well as important insights for practitioners in the field, which can aid to create a base for optimal athletic performance.

1. Introduction

A career as an elite athlete is extremely demanding, with constant pressure of performance, competition and high expectations as inherent features of elite sport. Still, sometimes the demands imposed on an athlete can exceed his or her resources for coping. In turn, this imbalance threatens their mental and emotional well-being which can lead to chronic stress and even burnout (Maslach & Leiter, 2000).

For adolescents, the involvement in elite sports is especially challenging (Teubert, Cachay, Borggreffe, & Thiel, 2006; Brettschneider, 1999). At this age, pursuing school is usually their only obligation, but the requirements of elite sport add to the challenges of adolescence itself, creating additional strain for young elite athletes. Since it has

been suggested that high stress levels and burnout symptoms foster early dropout of elite sport (Isoard-Gautheur, Guillet-Descas, & Gustafsson, 2016), sport-psychological researchers and practitioners recognize the need to elicit which athletes are at risk of athlete burnout and which conditions or dispositions make them susceptible.

1.1. Burnout vs. depression

Due to substantial proximity to and overlap with depression, the concept of burnout is discussed controversially within the scientific community (e.g. Bianchi, Schonfeld, & Laurent, 2015; Ahola, Hakanen, Perhoniemi, & Mutanen, 2014; Brenninkmeyer, Van Yperen, & Buunk, 2001). However, as this is not the focus of the present study, we will not discuss this issue in detail. While symptoms of depression are rather

Abbreviations: ABO, athlete burnout; Burnout-EXH, Burnout symptom ‘physical and emotional exhaustion’; Burnout-RA, Burnout symptom ‘reduced sense of accomplishment’; Burnout-DEV, Burnout symptom ‘sport devaluation’

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Abbreviations

ABO	athlete burnout
Burnout-EXH	Burnout symptom 'physical and emotional exhaustion'
Burnout-RA	Burnout symptom 'reduced sense of accomplishment'
Burnout-DEV	Burnout symptom 'sport devaluation'

general features of the individual's emotional state, burnout symptoms refer to the individual's level of functionality within a specific context – which in general burnout research is mostly job-related (Maslach, Schaufeli, & Leiter, 2001). For elite athletes, the specific context of functionality is elite sport. Here, functionality means being physically, mentally and emotionally capable to train and successfully compete under high pressure. For an athlete with burnout symptoms this functionality is inclined to be severely restricted (Gould & Dieffenbach, 2002).

1.2. Athlete burnout

Since the environment of elite athletes is very distinct from other work contexts, Maslach's definition of general burnout has been adapted to fit the sports context (Raedeke, 1997). According to this definition, athlete burnout (ABO) is characterized by three key symptoms: (a) Physical and emotional exhaustion (Burnout-EXH) describes a feeling of depletion of one's physical and emotional resources. (b) A reduced sense of accomplishment (Burnout-RA) is characterized by a decreased striving for athletic performance and (c) sport devaluation (Burnout-DEV) comprises a loss of interest and questioning the meaning of (elite) sport. There is relative agreement that Burnout-EXH represents the core symptom of (athlete) burnout (Gustafsson, Hassmen, & Hassmen, 2011a; Schaufeli & Buunk, 2003). Still, it has been shown that especially athletes with high scores of Burnout-RA and Burnout-DEV have a higher likelihood of dropping out of elite sport, as compared to athletes with only high Burnout-EXH scores (Isoard-Gautheur et al., 2016). Therefore, a definition including all three symptoms - as is most commonly used in recent ABO research - is necessary in order to characterize ABO as a multidimensional syndrome.

Even though the term 'burnout' suggests a final stage in which chronic stress has led to being completely 'burned out' with impaired functionality, this categorical conceptualization of burnout syndrome is rather uncommon among researchers today. Instead, a dimensional conceptualization, in which burnout is viewed as a process with the symptoms measured on a continuum, has been adopted (Cherniss, 1980) and is now employed more frequently (Schaufeli & Buunk, 2003).

It has been suggested that only individuals who are highly motivated ('being on fire') are at risk of burnout (Pines et al., 1993). Following this argumentation, athletes represent a risk group for developing burnout because high motivation, commitment and a high willingness to make sacrifices for the sport are key components of becoming a successful athlete (Durand-Bush, Salmela, & Green-Demers, 2001). Adolescent elite athletes represent an especially vulnerable subgroup due to their developmental stage. During this phase, in which important processes of identity and personality development as well as essential physical changes take place, adolescents are particularly impressionable causing them to be more fragile compared to adult athletes with higher psycho-socio-emotional maturity (Lupien, McEwen, Gunnar, & Heim, 2009). In order to decipher the mechanisms of ABO development and characteristics that foster or prevent burnout symptomatology, it is vital to assess athletes at a young age.

To date, there are no recognized thresholds for the explicit diagnosis of ABO. Hence, there is no theoretical base for a binary classification into healthy and burned-out individuals and thus determining prevalence is

difficult. Nevertheless, to be able to divide samples into so-called 'high' and 'low burners', some researchers have created cut-offs [cf. (Curran, Appleton, Hill, & Hall, 2011; Hodge, Lonsdale, & Ng, 2008; Raedeke, 1997)]. Others employed tertials of a population-based sample (Maslach, Jackson, & Leiter, 1996) for comparison, which suggest a prevalence of adolescent athletes experiencing high levels of burnout symptomatology (i.e. athletes with all three symptom scores in the highest tertial) of about 1–9% (Gustafsson, Kenttä, Hassmen, & Lundqvist, 2007). However, all of these procedures should be treated with caution as they have no sufficient theoretical base and no clinical value.

Undoubtedly, discussing the issue of ABO is valid. But regardless of the applied instrument and procedure, it becomes apparent that some athletes develop higher ABO symptoms than others, even though they all face the high demands of elite sport. When consulting general burnout research on this issue, burnout is considered to occur when the present demands exceed the available resources of an individual (Maslach & Leiter, 2000). Thus, a closer look at the ratio of demands and resources is recommended.

1.3. Athlete burnout as a function of demands and resources

Demands on young elite athletes are extremely high. On top of academic demands adolescent elite athletes are facing 700–800 hours of training annually, constant performance pressure and competitions (Gustafsson et al., 2011b). Therefore, it is not surprising that adolescent elite athletes also have higher overall stress levels than their non-athlete counterparts (Hoffmann, Sallen, Albert, & Richartz, 2012). More so, the developmental phase of adolescence constitutes a challenge (Coleman, 2011) and thus a demand in itself. In addition to substantial physical changes, major personality development takes place during those formative years. On a psychosocial level adolescents have to navigate so-called 'normative developmental tasks of adolescence' [cf. (Havighurst, 1956)], including detachment from the parents, identity building, and the development of personal values and beliefs. For adolescent elite athletes, the subculture of elite sport presents them with additional demands in form of sport-related developmental tasks (Ohlert & Kleinert, 2014), such as optimizing one's athletic performance or coping with high expectations, pressure, and failure (Ohlert, 2013). In order to fulfil these tasks, young athletes need positive social support. Parents, coaches, and other staff have a wide influence on the social climate of a young athlete which contributes considerably to the athlete's psycho-social development and development of a positive self-concept (Tamminen, Holt, & Crocker, 2012).

The above-mentioned challenges and their connection to ABO have been assessed in detail by various studies (see Table 1). However, it is important to note that most of these studies have focused on single or few ABO-correlates (e.g. perfectionism) and to date, a lack of a more comprehensive assessment of ABO-correlates remains. Years of burnout research have indicated that the genesis of burnout is complex and involves a variety of external demands and resources (e.g. environmental, structural, and social factors) as well as internal demands and resources, which are mostly defined by psychological variables (e.g. passion).

In terms of theoretical underpinnings, recent ABO research has mostly been aligned with frameworks, such as Deci and Ryan's (2008) self-determination theory (Lemyre, Treasure, & Roberts, 2006; Li, Wang, & Kee, 2013), or cognitive-affective models of stress and burnout (e.g. Gould & Dieffenbach, 2002; Smith, 1986). However, general burnout research considers an imbalance of the demands an individual is confronted with and their available resources as the source of burnout. This imbalance can then lead to a state of overload and exhaustion (Maslach & Leiter, 2000). Against this background, the *demand resource model* by Peter Becker (2003) offers an ideal theoretical underpinning for our study. The core idea of this model is that an

Table 1
Aspects that have been linked to ABO in previous research with respective research examples.

External demands and resources	
Aspects of training and competition	
Type of sport	(Dubuc-Charbonneau, Durand-Bush, & Forneris, 2014; Kenttä, Hassmen, & Raglin, 2001)
Time of socialization in elite sports	(Coakley, 1992)
Hours of training	(Gould and Dieffenbach, 2002; Kenttä et al., 2001)
Aspects of recovery	(Kallus and Kellmann, 2000; Kenttä & Hassmen, 1998)
Social aspects	
Social pressure	(Gould, Udry, Tuffey, & Loehr, 1997; Ommundsen, Roberts, Lemyre, & Miller, 2006)
Social support	(Krippel & Ziemainz, 2010; Ommundsen et al., 2006)
Coach's style of leadership	(Harris & Ostrow, 2008; Isoard-Gauthier, Guillet-Descas, & Lemyre, 2012)
Internal demands and resources	
Psychological aspects	
Perceived stress	(Kenttä et al., 2001; Raedeke & Smith, 2004)
Perfectionism	(Hill & Curran, 2016)
Passion	(Curran et al., 2011; Gustafsson et al., 2011b)
Optimism	(Gustafsson & Skoog, 2012)
Health aspects	
Depressive symptoms	(Bianchi et al., 2015)
Sleeping pattern	(Krippel & Ziemainz, 2010)
Biography of injury	(Cresswell & Eklund, 2006a, 2006b)
Health perception and –satisfaction	(Krippel & Ziemainz, 2010)
Demographic aspects	
Gender	(Heidari, 2013; Smith, Gustafsson, & Hassmen, 2010)
Age	(Harris & Watson, 2011)

individual's state of health depends on the ability to handle external and internal demands with the means of external and internal resources. Here, 'external' means any demands and resources that stem from the individual's environment or given structural factors, while 'internal' includes any demands and resources that originate from within the individual, their beliefs and personality features. The demand resource model provides an ideal fit for our study rationale for the following four

reasons: Firstly and as illustrated in Fig. 1, all of the correlates from previous ABO research [cf. (Table 1)] can be integrated into this model. Secondly, the model incorporates both external and internal factors, as is important in the genesis of ABO. Thirdly, the model allows for possible interactions between said factors, which general burnout research has deemed important (cf. Maslach & Leiter, 2000). Fourthly, the model's outcome variable is the individual's state of health, which in our study relates specifically to ABO symptomatology.

1.4. Study approach

Recent ABO research has gathered valuable information regarding the conceptualization of ABO itself (see reviews by Cresswell and Eklund, 2006a, 2006b; Eklund & DeFreese, 2015) as well as identified antecedents, risk factors, and consequences of ABO (e.g. review by Gustafsson et al., 2011a). Nevertheless, certain research desiderates remain.

Firstly, the vagueness of diagnostic criteria impedes identifying individuals with ABO. Due to its conceptualization as a process, many researchers have refrained from defining explicit cut-off points for ABO diagnosis. Nevertheless, despite a lack of a theoretical base, some researchers have applied cut-off values (Curran et al., 2011; Hodge et al., 2008). Secondly, elite sports systems including opportunities, resources, and funding vary between nations. Thus, it is important to assess ABO nation-specifically, which for the German elite sport is still in its infancy. Thirdly, and most importantly for our project, many studies in the field are selective when assessing ABO correlates and often consider only single factors (e.g. perfectionism, see Hill, Hall, & Appleton, 2010) and neglect to assess interactions of influencing factors of ABO (see review by Goodger, Gorely, Lavallee, & Harwood, 2007). While a selective approach offers in-depth information on the respective correlate in focus, it also disregards the complexity of the concept of ABO and the variety of correlates. This third desiderate is especially meaningful as it fails to take into account general burnout research which clearly states that burnout is the product of an interaction of contextual and personal factors (Maslach & Leiter, 2000).

In the present study, we aim to address these research desiderates constructively. To avoid relying on cut-off scores, we chose to focus on the two extreme groups, those with the highest and those with the lowest burnout symptomatology. Since large samples are needed to reach meaningful results, we assessed a sample of 1138 German adolescent elite athletes. Moreover, in terms of the number of correlates

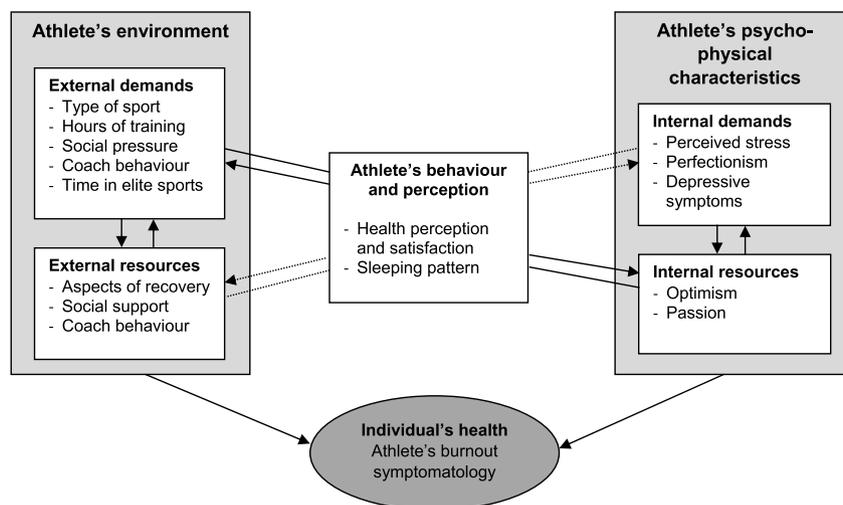


Fig. 1. Adapted version of Becker's demand resource model for our study purposes.

included while incorporating possible interactions between the respective correlates, we aim to take a more comprehensive approach to the topic of ABO in adolescent elite athletes than many previous studies. Following previous research, all of the correlates included could show significant associations with ABO. However, as we are analyzing extreme groups, we are not testing each of the correlates for its relationship with ABO symptomatology. Instead, we concentrate on the profile characteristics that the athletes with the most extreme (highest or lowest) ABO symptomatology levels have in common, creating a high (or low) risk cluster profile. Therefore we do not propose hypotheses and the present study remains exploratory in nature. Only by deciphering the demand and resource features relevant to ABO and the interactions between those features, we can provide a base for future hypothesis-testing studies and a knowledge base for athletes, coaches, parents, staff, and elite sport associations.

With regards to a recent review (Gustafsson, DeFreese, & Madigan, 2017), which called for studies determining distinct ‘burnout profiles’ using a person-centered approach, in our study, we focus on identifying the factors that best characterize and differentiate a sample of athletes regarding burnout symptomatology. More specifically, by comparing contrast groups we want to assess (I) which context and personal factors indicate especially high or low susceptibility to athlete burnout? Further, we want to determine (II) whether we can identify risk feature combinations that heighten the risk for athlete burnout?

2. Method

2.1. Participants and Recruitment procedure

Subjects were adolescent athletes ($N = 1138$, 500 female) with a mean age of 16.33 years ($SD = 1.10$) who were all part of the national

youth squad within their sport. Athletes of all Olympic disciplines (related to the Summer Olympics 2012 and Winter Olympics 2010) were included in this study in order to obtain a comprehensive overview of German elite athletes. Data were collected between February 2010 and January 2011 as a part of the research project “The German Young Olympic Athlete’s Lifestyle and Health Management Study” (GOAL) funded by the Federal Institute of Sports Science. Questionnaires were sent out via direct mail, centralized distribution or at centralized squad practices. Our sample comprises 62% of the adolescent elite athletes born between 1992 and 1995 (Thiel et al., 2011). An analysis of responders and non-responders regarding age and gender showed no significant differences (Diehl, Thiel, Zipfel, Mayer, & Schneider, 2012). This study was approved by the ethics commission of the Faculty of Medicine at the University of Tübingen under the signature 222/2009BO1.

2.2. Measures

Athlete burnout. Recent studies on burnout in elite athletes have mostly employed the „Athlete Burnout Questionnaire” (ABQ by Raedeke & Smith, 2001). We utilized its validated German version (ABQ-D by Ziemainz, Abu-Omar, Raedeke, & Krause, 2004). This 15-item-questionnaire is adapted to the sports environment and is based on the three key symptom dimensions: Physical and emotional exhaustion, reduced sense of accomplishment, and sport devaluation. Items were answered on a 5-point rating scale ranging from 1 = “almost never” to 5 = “almost always”. The measure was adapted to the sports context utilizing a number of items from the Maslach Burnout Inventory (Maslach et al., 1996). The authors advised that the three subscales should be measured individually as this would be more precise, and not be combined to an overall burnout score as this would not add value.

Table 2
Overview of the variables that were included in the analysis as independent variables.

Variables	Explanation/Example item
Aspects of training and competition	
Type of sport	Categorization adapted from Sundgot-Borgen and Torstveit (2004)
Time of socialization in elite sports	Time since squad nomination
Level of competition / squad level	National squad level: A, B, C or D/C
Hours of training	Hours of training per week
Days of competition	Days of competition per season
Aspects of recovery	Frequency of regenerative measures (e.g. massage, relaxation exercise, sauna, ice bath, regenerative gymnastics or regenerative endurance training)
Social aspects	
Social pressure	e.g. “When I mention being in pain, my social environment reacts with reproach.”
Main social contact	Main social contact within (e.g. coach) or outside sport (e.g. friends outside sport)
Coach behavior	Style of leadership (autocratic, laissez-faire or democratic)
Relatives involved in elite sport	Any relatives involved in elite sport
Aspects of hyperinclusion	e.g. “Life without sport is pointless.” (agree/disagree 5-point-scale)
Psychological aspects	
Perceived stress outside of sport	Perceived stress related to school, family & friends outside of sport
Perfectionistic striving	e.g. “I should either do everything perfectly or not at all.” (never/very often 5-point-scale)
Willingness to make psychosocial sacrifices	e.g. “Due to my sport I have no time left for friends and family.” (agree/disagree 5-point-scale)
Willingness to make physical sacrifices	e.g. “I am prepared to endure chronic pain in order to succeed in my sport.” (agree/disagree 5-point-scale)
Willingness to play hurt	e.g. “I am good at ignoring great pain during competition.” (agree/disagree 5-point-scale)
Health-related carefreeness	e.g. “I am not worried about my health.” (agree/disagree 5-point-scale)
Health aspects	
Depressive symptoms	PHQ-4, Depression screening within the Patient Health Questionnaire
Hours of sleep	Frequency per week of less than 6 h of sleep
Biography of injury	Sick days per season (training & competition)
Health perception and satisfaction	Absolute and relative subjective health appraisal & satisfaction
Demographic aspects	
Gender	
Age	
Mother tongue	
Type of school	German school system is divided into different types of schools with increasing academic level

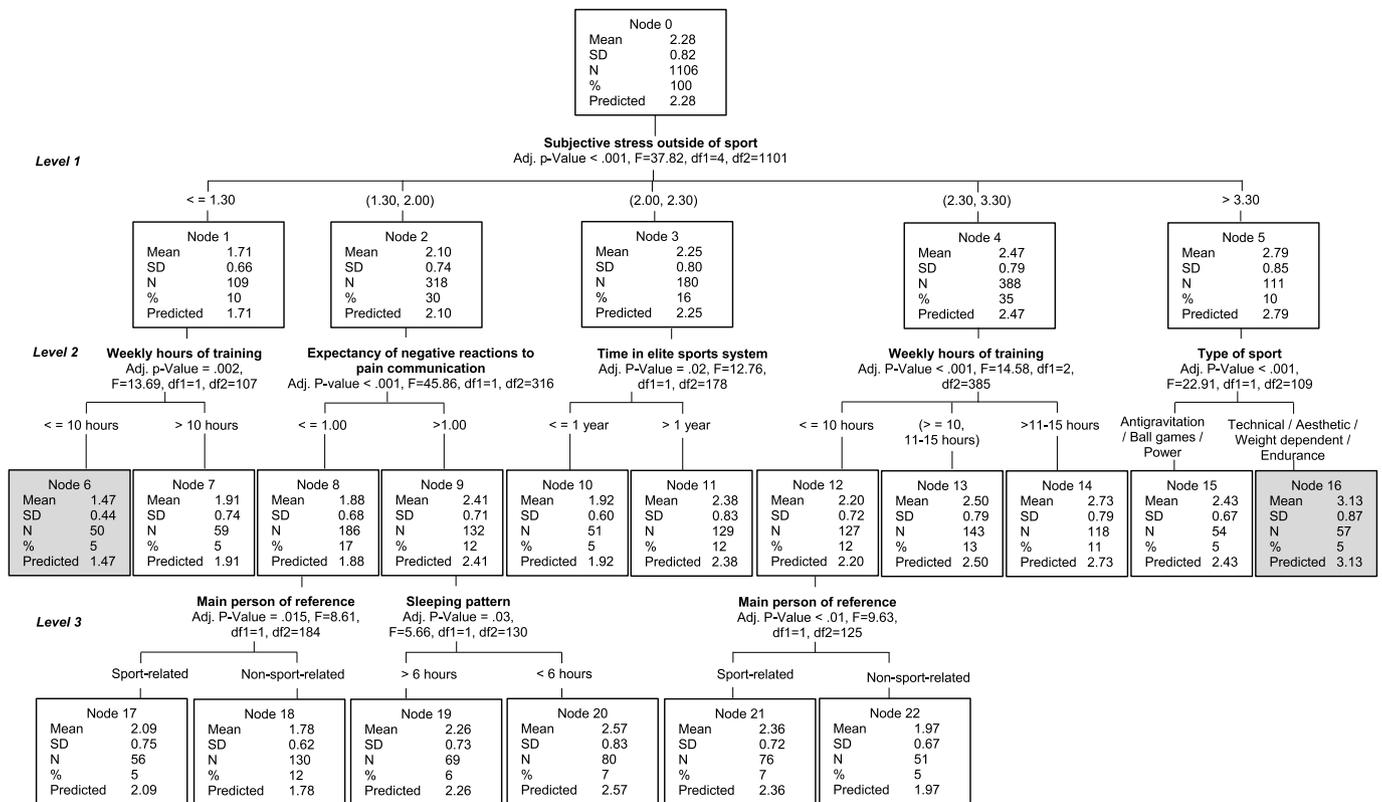


Fig. 2. Classification tree analysis for physical and emotional exhaustion (Burnout-EXH). Terminal nodes with highest and lowest mean scores are shaded grey.

The ABQ has shown good reliability and validity in a range of athlete populations (Raedeke & Smith, 2009) and also for youth athletes (Sharp, Woodcock, Holland, Duda, & Cumming, 2010). Analyses of the ABQ-D also reached satisfying reliability and validity (Ziemainz et al., 2004).

Correlates included in the analysis. As we aimed to obtain a comprehensive view on the relevant correlates of adolescent ABO, we included most of the factors that previous research identified as important in the genesis of ABO (cf. Table 1) as well as sociodemographic characteristics. These variables were obtained through parts of a 24 page composite questionnaire consisting of a total of 85 questions covering a wide range of health-related topics (see Table 2, for details see Thiel et al., 2011).

2.3. Statistical analyses¹

Data analyses were carried out using the statistic software IBM SPSS Statistics 23. We chose to analyze the data via classification tree analysis (CTA). This approach is person-centered as it enables the identification of “groups of individuals who share particular attributes or relations among attributes” (Laursen & Hoff, 2006). CTA has been recommended by several researchers (Alkhasawneh, Ngah, Tay, Mat Isa, & Al-Batah, 2014; Chen, Shih, Lin, Chen, & Lin, 2012; Lemon, Roy, Clark, Friedmann, & Rakowski, 2003) as it represents an appropriate statistical tool which “allows for exploratory identification of contrast groups” (Mayer & Thiel, 2014; Schnell, Mayer, Diehl, Zipfel, & Thiel, 2014) based on potential determinants. Furthermore it holds the advantages of detecting interactions between the potential determinants and illustrating their level of impact in a hierarchical tree model (Bühl, 2012; Camp & Slattery, 2002).

¹ Data from the GOAL-study were analysed regarding various health aspects and included a preliminary analysis of burnout symptoms: These analyses were included in the PhD thesis of author A. Schnell.

We chose to apply the Exhaustive CHAID algorithm ('Exhaustive Chi-squared Automatic Interaction Detector', see Camp & Slattery, 2002), as it is more appropriate for our purposes than the CHAID algorithm, which does not always form ideal categories of the predictor because the categorization process is suspended as soon as all identified categories differ significantly from each other (Camp & Slattery, 2002).

As specific ‘stopping rules’ for the analysis, we set the level of significance for the splitting of nodes and the merging of categories at 0.05. The depth was set at 3 and the minimum amount of cases in parent nodes was set at 100 and at 50 for child nodes. Reliability measures were calculated using the risk estimate of misclassification (variance within the nodes). The quality of a tree model was calculated via the explained variance of the tree (variance between the nodes).

3. Results

We conducted classification tree analyses with three different dependent variables, one for each symptom of athlete burnout (Burnout-EXH, Burnout-RA and Burnout-DEV). The results reported here relate to the extreme groups (highest and lowest ABO symptomatology) as determined by each CTA and as described below in more detail.

3.1. Contrast groups for Burnout-EXH (see Fig. 2)

The trees have to be read from top to bottom. The root node includes the whole sample. On the first level, the algorithm identifies the independent variable (subjective stress outside of sport) that best splits the sample into groups regarding the respective dependent variable (Burnout-EXH). It chooses one specific independent variable that forms groups with greatest possible homogeneity within, and greatest possible heterogeneity between each group regarding the dependent variable (Burnout-EXH). This procedure is repeated until the stopping rules - as mentioned in chapter 2.3 - apply. For each node the mean indicates the group mean of the dependent variable. The cut-points for each

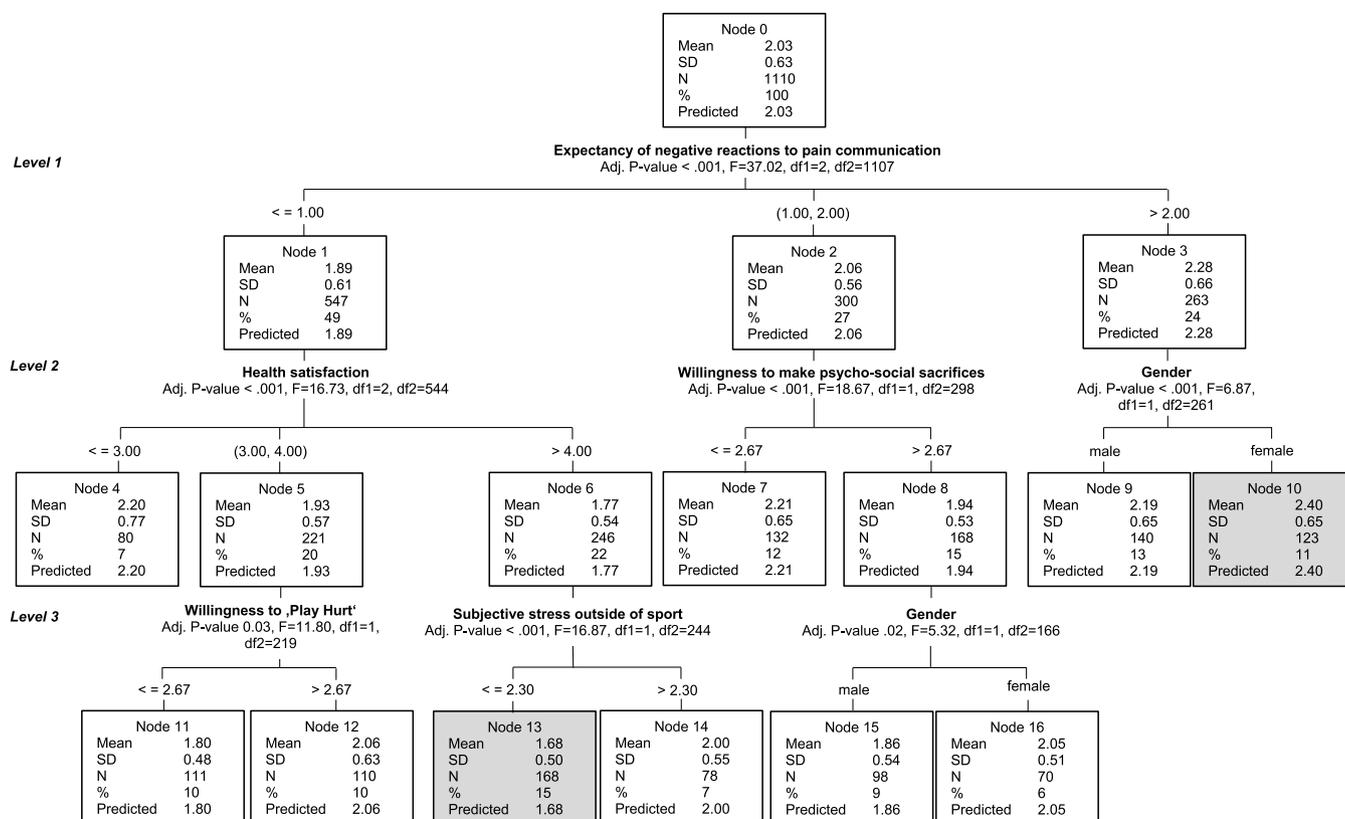


Fig. 3. Classification tree analysis for reduced sense of accomplishment (Burnout-RA). Terminal nodes with highest and lowest mean scores are shaded grey.

independent variable are indicated above each node. This method produces a certain number of final nodes (14 final nodes). Here, we discuss only the final nodes with the highest and the lowest group mean (node 16 and node 6) regarding the dependent variable (Burnout-EXH).

High-risk group - node 16: The highest symptoms of Burnout-EXH are found in athletes who feel the highest amount of stress outside of sport (node 5) when also being involved in technical, aesthetic, weight-dependent or endurance sport (node: 16; $M = 3.13$, $SD = 0.87$).

Low-risk group - node 6: Athletes with lowest amount of stress outside of sport (node 1) report the lowest symptoms of Burnout-EXH when training equal or less than 10 h per week (node 6; $M = 1.47$, $SD = 0.44$).

3.2. Contrast groups for Burnout-RA (see Fig. 3)

Following the same procedure, CTA reveals 10 final nodes for Burnout-RA. Node 10 makes up the high-risk group for Burnout-RA. This node includes athletes who have a high expectancy of negative reaction when communicating pain (node 3) and are female (node 10: $M = 2.40$, $SD = 0.65$). The low-risk group for Burnout-RA is represented in node 13. This group incorporates athletes with no fear of getting negative reactions to communication of pain (node 1) who then reach the lowest results regarding Burnout-RA when feeling satisfied with their state of health (node 6) and when reporting low levels of stress outside of sport (node 13: $M = 1.68$, $SD = 0.50$).

3.3. Contrast groups for Burnout-DEV (see Fig. 4)

For Burnout-DEV, CTA reveals 12 final nodes. Node 11 represents the high-risk group for Burnout-DEV. This node includes athletes with a relatively weak willingness to accept psychosocial risks (node 2) who also train under an autocratic or laissez-faire coach (node 5) and sleep less the 6 h per night (node 11: $M = 2.28$, $SD = 0.77$). The low-risk group for Burnout-DEV is represented in node 14. This group

incorporates athletes who are willing to risk their own psychosocial health to a high but not extreme extent (node 3) and who are not expecting negative reaction to communication of pain (node 7) combined with relatively low levels of stress outside of sport (node 14: $M = 1.35$, $SD = 0.38$).

3.4. Quality of the statistical model

The explained variance of the model, or variance between the nodes, was 22.6% for Burnout-EXH, 13.2% for Burnout-RA, and 18.8% for Burnout-DEV respectively.

The risk estimate for misclassification for Burnout-EXH was equal to 0.523 ($SE = 0.022$) and a 10-fold cross-validation yielded a risk estimate equal to 0.616 ($SE = 0.027$). For Burnout-RA the risk estimate for misclassification was 0.341 ($SE = 0.016$) and a 10-fold cross-validation gave a risk estimate equal to 0.367 ($SE = 0.018$). For Burnout-DEV the risk estimate for misclassification was 0.333 ($SE = 0.018$) and a 10-fold cross-validation resulted in a risk estimate equal to 0.377 ($SE = 0.020$).

3.5. Integration within the theoretical model

The variables produced by our analysis can be placed within Becker's demand resource model (see Table 3). This model includes four types of influence factors: External demands are structural demands, which are determined by an external system or person (e.g. the hours of training set by the coach, academic demands or expectations of the family). Internal demands are mostly based on individual (psychological) needs and internalized norms and values, such as perfectionism, needs satisfaction or individual expectations. External resources are structural resources, such as social support or financial stability. And internal resources include action beliefs, attitudes to life and advantageous personality facets (e.g. optimism, high perceived self-efficacy, see Becker, Schulz, & Schlotz, 2004). While some variables can be allocated easily, it is important to note that some variables can be interpreted in

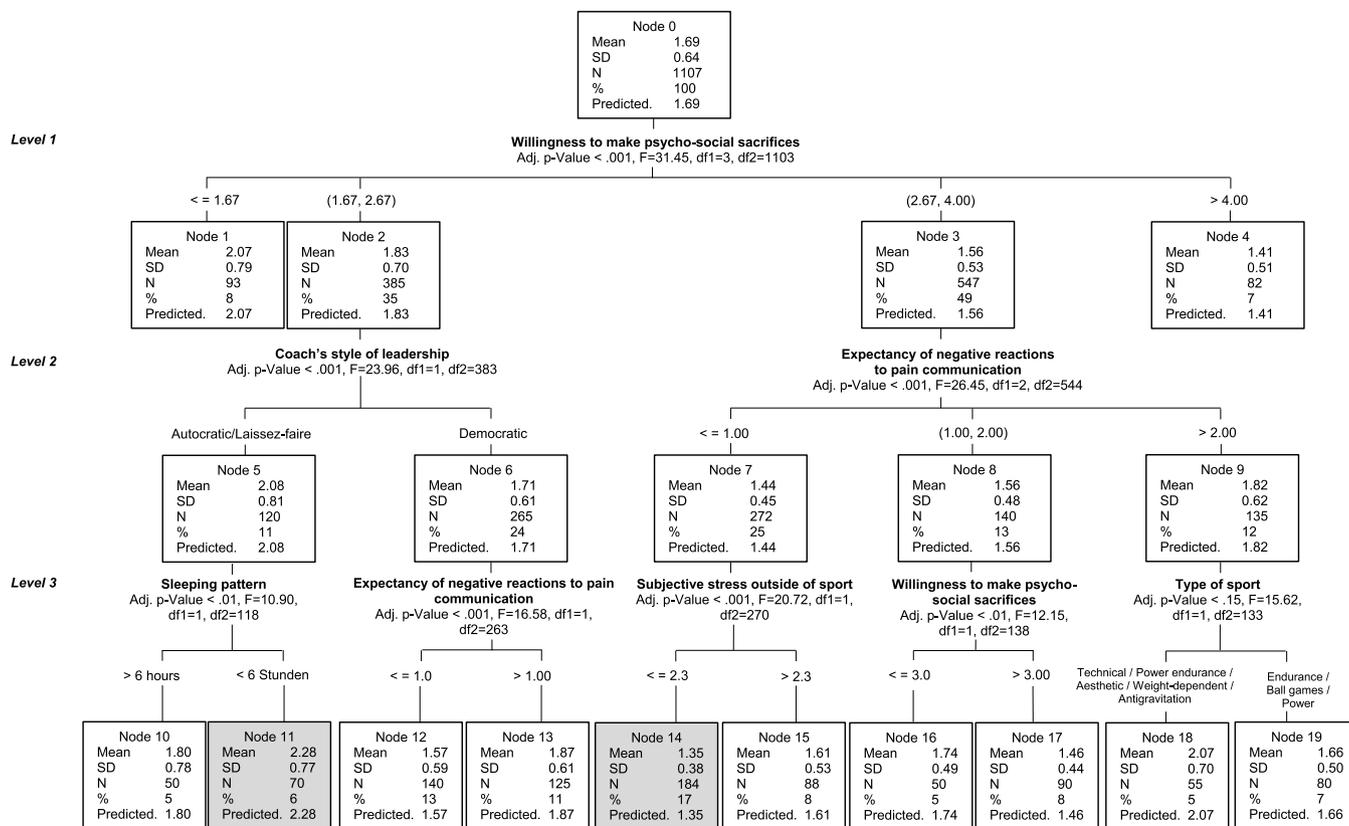


Fig. 4. Classification tree analysis for sport devaluation (Burnout-DEV). Terminal nodes with highest and lowest mean scores are shaded grey.

two ways, as either internal or external. This ambiguity is due to the fact that for some variables (e.g. sleeping pattern), it is not possible to determine whether its manifestation (here < or > than 6 h) is based on the athletes' environment (e.g. time-wise strain, full schedule) or internal processes (e.g. inner unrest or rumination). In addition, there are some variables which rather constitute a reduced demand than a favourable resource (e.g. low subjective stress outside of sport), while others rather represent an adverse resource than an unfavourable demand (e.g. lower willingness to make psycho-social sacrifices).

4. Discussion

Our assessment of a wide range of ABO correlates amounted to nine variables, which appear relevant in characterizing those athletes with the highest and lowest burnout symptomatology, respectively. With regards to Becker's demand resource model, we found confirmation of the assumption in general burnout research that the interactions between demands and resources play a key role in the genesis of ABO (Maslach & Leiter, 2000). More precisely, our statistical approach allowed us to identify especially risky and protective feature combinations. These feature combinations showed that mostly both feature types, demands and resources, interacted to characterize the extreme groups of ABO symptomatology (see Table 3). Moreover, it is especially interesting that the associated features and feature combinations vary for each of the three symptoms of ABO, which endorses the procedure of analysing the three symptoms separately.

In the following, the nine variables, that were identified as relevant in characterizing those athletes with the highest and those with the lowest ABO symptomatology, will be discussed separately for each of the three symptoms. In order to avoid reiteration, those variables that are relevant to more than one symptom will only be discussed once.

4.1. Burnout-EXH

Our finding, that the highest levels of Burnout-EXH are experienced by athletes with a high level of subjective stress outside of sport, who are also involved in either a technical, endurance, aesthetic, or weight-dependent sport (as opposed to ball games, power sports, antigravitation), underlines the importance of compatibility of sport-related and non-sport-related structures.

A high level of subjective stress outside of sport constitutes a demand for young athletes, but is a composite characteristic of both external and internal demands. Externally, the level of subjective stress outside of sport depends on the objective non-sport-related demands that an athlete is facing (e.g. academic requirements, expectations from social environment). Internally, the athlete's perception and appraisal of these non-sport-related demands contribute to his or her level of subjective stress. This finding is not surprising since any strain outside of sport automatically constitutes an additional burden on top of the demands of elite sport itself (cf. Gustafsson & Skoog, 2012). For adolescent athletes, stress outside of sport is often related to school requirements, such as maintaining certain grades or social expectations, like spending time with friends and family.

The finding, that being involved in an either technical, endurance, aesthetic or weight-dependent sport constitutes an external demand, is novel: Previous research has mostly focussed on comparing burnout levels of individual versus team sport athletes, with inconclusive results. Some studies found individual sport athletes showing a higher incidence of burnout than team sport athletes (Kenttä et al., 2001), others found no differences between the two groups (Gustafsson et al., 2007). Comparisons between individual and team sport athletes may, however, be problematic as for example shot-putters and figure-skaters are both involved in individual sports but their specific sport and training environments and characteristics do not show a lot of resemblance. Thus, for our study we refined categories based on the division

Table 3

Overview of the correlates relevant in characterizing the extreme groups, separately for each ABO symptom and classified according to the demand resource model (demand/resource x internal/external).

	demand		resource	
	internal	external	internal	external
<i>Physical and emotional exhaustion</i>				
- High subjective stress outside of sport	(x)	(x)		
- Type of sport		x		
- Low subjective stress outside of sport	(x) red.	(x) red.		
- Less hours of training		x red.		
<i>Reduced sense of accomplishment</i>				
- High expectancy of negative reaction to pain communication		x		
- Female gender	(x)	(x)		
- Low expectancy of negative reaction to pain communication				x
- High individual health satisfaction			x	
- Low subjective stress outside of sport	(x) red.	(x) red.		
<i>Sport devaluation</i>				
- Lower willingness to make psychosocial sacrifices			x adv.	
- Autocratic or laissez-faire coach		x		
- Less hours of sleep	(x)	(x)		
- Higher willingness to make psychosocial sacrifices			x	
- Low expectancy of negative reaction to pain communication				x
- Low subjective stress outside of sport	(x) red.	(x) red.		

Note. 'x red.' indicates that the respective correlate constitutes a reduced demand rather than a (positive) resource. 'x adv.' indicates that the respective correlate constitutes an adverse (or unfavourable) resource '(x)' indicates that the respective correlate is ambiguous and cannot be classified as strictly external or internal.

of Sundgot-Borgen and Torstveit (Sundgot-Borgen & Torstveit, 2004). Within this classification, disciplines are categorised into six different types of sport, which share similar physical demands.

Our finding, that the lowest scores of Burnout-EXH are experienced by athletes with a low level of subjective stress outside of sport, who also train equal to or less than 10 h per week, is mostly in line with previous research.

It seems reasonable that a *lower level of non-sport-related stress* is associated with lower ABO (cf. Gustafsson & Skoog, 2012). However, it remains unclear whether the respective athletes experience low subjective stress outside of sport because they objectively have fewer non-sport-related demands or whether it is due to efficient coping strategies. This uncertainty also suggests two possible placements within our theoretical model: In the first case low non-sport-related stress can be classified as an external reduced demand while in the second case it is influenced by an internal resource, namely coping.

The *extent of training* is seemingly one of the most obvious correlates with respect to stress and burnout. However, contrary to previous studies (e.g. Krippel & Ziemainz, 2010), our results do not explicitly show that extensive hours of training are associated with heightened burnout symptoms. Instead, training less than or equal to 10 h per week constitutes an external reduced demand and thus, is associated with lower ABO symptomatology. Since each training session represents physical and cognitive demands (Pelka et al., 2017) and fewer hours of training generally mean less time-wise strain for the athlete, fewer hours of training can likely protect against exhaustion. Nevertheless, in elite sport it is a common challenge to have to adapt the training load to a level that increases performance but does not exceed an athlete's exercise tolerance and endangers them in terms of overtraining and

exhaustion (Naughton, Farpour-Lambert, Carlson, Bradney, & Van Praagh, 2000). As these tolerance levels are the product of a highly complex interaction of physical, mental and social factors and as such are distinct for every athlete, determining the appropriate amount of training requires coaches to be in close communication with their athletes and sensitive to this balancing act (Schubring, Bub, & Thiel, 2015).

4.2. Burnout-RA

Our finding that the highest levels of Burnout-RA are experienced by female athletes who expect negative reactions from their social environment when they communicate pain, partially parallels with previous research.

When athletes expect negative reactions from their social environment (e.g. coach, parents, peers) when they are injured or experiencing pain, this constitutes an external demand in the form of added *social pressure*. More specifically, the high level of functionality, commitment, and endurance that are expected within the elite sports system, can lead to the impression that injuries are a natural part of elite sport and that admitting to pain or suffering from an injury is considered a weakness (Malcolm, 2006). Consequently, it is intelligible that this inherent fear causes additional stress and hence fosters burnout symptomatology. Further, the coach-athlete relationship is hierarchy-based, because the coach is not only older and possesses more experience and a higher social status, he or she also has a considerable amount of decision power over the entrusted adolescent athlete (Cassidy, Jones, & Potrac, 2009). This power dynamic is very likely to obstruct a trust-based communication between adolescent athletes and their coach. The athlete has to constantly prove him- or herself to their coach in order to be nominated or promoted, which may lead to them hiding any pain or injury.

The finding that *female* adolescent elite athletes show higher scores of burnout symptomatology reflects suggestions of other studies (e.g. Heidari, 2013), but overall research on the existence of gender differences in ABO is ambiguous (Smith et al., 2010). Our results may be attributed to the fact, that female elite athletes are likely to perceive physical changes during puberty as extremely negative (Schubring, 2014), because the resulting poorer load-power-ratio often (temporarily) decreases their performance (Malina, 2002). The physical changes during puberty are generally perceived as stressful for any adolescent (Coleman, 2011). But within the elite sport, the body plays a uniquely central role related to the athlete's functionality. This focus far exceeds the usual awkwardness and pressure to achieve certain body ideals. Instead, in elite sport the body composition largely determines the athlete's performance potential and therefore their perceived worth in the sports environment.

The finding, that the lowest levels of Burnout-RA are displayed by athletes, who expect few or no negative reactions from their social environment when communicating pain, who are satisfied with their own health, and who experience low non-sport-related stress, underlines the importance of resources.

The social environment of adolescent elite athletes is vital to their performance and well-being and therefore, the level of support plays an important role with regards to ABO. The way the social environment of a young athlete is *responding to injury or pain* is an indicator of the level of social support. When athletes are not afraid to communicate pain - because they do not expect their social environment to respond negatively - this can work as an external resource.

Our result that a *high health satisfaction* represents an internal resource, can be attributed to the fact that health is an essential requirement in elite sport. A good state (or perception) of the athlete's own health equals his or her sufficient level of functionality. Also, previous research established that athletes with a high subjective performance ability show lower burnout symptomatology (Lemyre, Hall, & Roberts, 2008).

4.3. Burnout-DEV

Our finding that the highest scores of Burnout-DEV are experienced by athletes with a low willingness to make psycho-social sacrifices, who also train under an either autocratic or laissez-faire coach, and who also frequently sleep less than 6 h per night, emphasizes the importance of acknowledging both internal and external features.

An athlete's *willingness to make psycho-social sacrifices* appears to be an important psychological feature in the context of ABO. Athletes, who are not willing to put up with the extensive psychological and psycho-social strains inherent to elite sport, may suffer additional stress because they repeatedly dispute, whether their commitment is worth the sacrifices. Therefore, a low willingness to make psycho-social sacrifices represents an internal adverse resource.

The *coach* is usually one of the most important persons of reference for an adolescent athlete and also strongly shapes the training atmosphere. Parallel to the findings of Harris and Ostrow (2008), our results show that training under an autocratic coach, who strictly enforces his or her own decisions and is not prepared to compromise, is associated with heightened ABO levels. This finding can be linked to the basic need for autonomy and individual control (Coakley, 1992; Hodge et al., 2008), which may be restricted under an autocratic coach (Brinton, Hill, & Ward, 2017). Our results also showed the same association for training under a laissez-faire coach, who generally provides only few or no rules and structure and tends to overindulge the athlete. Previous literature on the effects of laissez-faire coaching is scarce, but laissez-faire parenting has been associated with negative effects on adolescent behaviour, performance, and health (Sanrock, 2004). Hence, our results relate to previous research and show that training under an autocratic or laissez-faire coach, as compared to training under a democratic coach, who includes the athlete in the decision-making process and values his or her opinions, poses an external demand.

Sleep is one of the most important parts of recovery and is especially vital for adolescent athletes in their specific developmental phase. Athletes need healthy sleeping patterns to be able to meet the requirements of elite sport while remaining mentally healthy. Therefore, it is not surprising that frequently getting less than 6 h of sleep per night constitutes an additional demand. Previous research was able to connect a lack of sleep in athletes with decreasing enthusiasm for their sport (Krippel & Ziemainz, 2010). Still, due to the cross-sectional design it is not possible to determine the direction of effect. Thus, we cannot say whether a lack of sleep leads to increased burnout symptoms or whether stress and overload give rise to disordered sleeping patterns and sleep deprivation.

Our finding that the lowest levels of Burnout-DEV are displayed by athletes with a high willingness to make psycho-social sacrifices, who have a supportive environment even when they are injured, and who experience low levels of non-sport-related stress, shows similarities with the findings of the group with the lowest symptoms of Burnout-RA.

Athletes, who are highly *willing to make psycho-social sacrifices* for their sport, hold an internal resource which can help to prevent ABO. This willingness to make psycho-social sacrifices can be considered as an operationalisation of passion for their sport. Harmonious passion has been associated with lower ABO symptomatology in adolescent elite athletes (Curran et al., 2011). Moreover, a high willingness to make psycho-social sacrifices can also be viewed as an effect of hyperinclusion, whereby an athlete is entirely socialized within the elite sports environment and has internalized the accustomed belief in the necessity of sacrificing everything for athletic success (Mayer & Thiel, 2014; Schnell et al., 2014).

Overall, we would like to emphasize that our results do not define predictors of ABO. Instead, through our analysis we can provide specific high and low risk profiles of ABO for adolescent athletes. Within this approach, we do not only take into account the multicausality of the ABO syndrome, but also allow for interactions between the correlate features. We would like to emphasize that these features do not stand

alone in their relation to ABO symptomatology. In fact, our results let us assume that adverse external conditions can be compensated by favorable internal resources. This relates to the rationale of global burnout research, which states that burnout originates from a combination of personal and contextual factors. But more importantly, this knowledge points towards the meaningfulness of strengthening young athletes' internal resources. This can be achieved through the employment of trained sport psychologists. With the means of trainings, such as the psychological skills training (Sheard & Golby, 2006), these professionals can closely work with the athletes on improving their psychosocial resources and thus alleviate their risk of developing burnout symptoms.

5. Limitations, implications and future directions

Although promising results were obtained in the current study, certain limitations should be noted. Our study aims at taking a more comprehensive approach to youth athlete burnout than previous studies. Future studies could benefit from including further ABO-related psychological aspects (e.g. self-esteem, motivation).

Due to content-wise overlap, we excluded some variables from the analyses. Given the substantial proximity of burnout and depressive symptoms (Bianchi et al., 2015), we did not include depressive symptomatology in the extreme group analyses. We also excluded sport-related perceived stress as we considered it partially redundant to ABO symptomatology (high correlation, specifically with Burnout-EXH) and keeping it as part of the analysis would have led to methodological issues.

On a methodological level, it is important to note that the measurement of (athlete) burnout entails some issues. Firstly, there is still a debate on the time- and content-wise interrelationship between the individual burnout dimensions (Lundkvist et al., 2017) as well as the necessity of multiple dimensions (Gustafsson, Madigan, & Lundkvist, 2018). Secondly, the lack of substantiated diagnostic criteria strongly impedes research in this respective field. This second issue holds true for nearly all burnout instruments, with the only exception being the Shirom-Melamed Burnout Questionnaire (SMBQ), which up until very recently has not been used in the sport context (Gerber et al., 2018a, 2018b). Contrary to that, the ABQ has been developed specifically for athletes and as such has been used multiple times in the sport context. Thus, for comparison with recent research in the field, the ABQ is the most appropriate instrument for our purpose. As for the issue of diagnostic criteria, previous studies have mostly employed basic regression analyses. We chose to focus on the extreme groups because with this approach we gain a more specific view of those athletes that are particularly of interest, which can be helpful in preventing ABO. Further, we can assume that - wherever the "true" cut-off may lie - our high burner group, which contains those athletes with the highest ABO symptom scores, is very likely to score above said cut-off. However, we acknowledge that this approach is rather a way that works around the issue than one that directly addresses it.

Methodologically, one could also criticize that our data included self-reports only. Adding evaluations from a coaches' or parents' point of view may have helped to get a more objective view on the athletes' features. However, as burnout symptomatology depends on the individual's appraisal of demands, resources, and related emotions, we considered the athlete perspective to be suitable for our study purpose. As with most survey studies, it is possible that answers of study participants may have been influenced by social desirability. For example, athletes may have answered questions regarding health, well-being, and performance ability untruthfully, due to a fear of being judged as weak within the highly functional elite sport context. However, as participants were briefed thoroughly on anonymity of their data, this effect should be rather marginal. In order to be able to decipher the process of ABO, the order of occurrence of the three symptoms, and possible causal relationships between correlate features and

symptomatology, longitudinal data are required. Unfortunately, collecting data over a longer period of time, a few years even, is rarely feasible and even more so for this specific population due to varying squads and dropouts. However, if possible, future research should strongly consider conducting longitudinal studies.

In addition to providing a base for future ABO research, our findings also generate valuable practical implications for elite sport. Our results suggest that young athletes need an environment in which non-sport-related stress is low and in which they can still manage the necessary hours of training. Practical suggestions could be to enroll young athletes in special (boarding) schools for elite sport, which try to ensure feasibility of both athletic and academic requirements by providing a structure of flexible schedules and short distances between academic, training, and housing facilities (Sportbund, 2003). Nevertheless, attending special schools for elite athletes and nearly exclusively socializing with other athletes may also lead to the development of a restricted athlete identity (Mitchell et al., 2014), whereby the afflicted athletes only align themselves in the elite sport environment. This exclusive focus often diminishes friendships and socialization outside of sport, so in case of dropping out of elite sport these youths often lack a support system to fall back on (Sanders & Stevinson, 2017). Therefore, especially for adolescent athletes who attend elite sport schools, social contacts outside the elite sport environment should be encouraged.

Furthermore, our results suggest that some behaviours can be connected to stress and ABO symptomatology. Hence, we suggest that coaches and staff remain attentive to their athletes' behaviour, as for example irregularities of sleep or dietary changes could also be indicators of extensive stress.

Our findings also emphasize the importance of the adults involved in an adolescent athlete's life. The finding that autocratic and laissez-faire coaching styles are associated with heightened ABO symptoms should be considered in the selection and development of coaches in German elite sport. As it is vital to create a supportive and considerate environment for the athletes, parents need to be educated on their

influence on their children's well-being in order to avoid adding social pressure (Knight, Berrow, & Harwood, 2017). Moreover, the employment of sport psychologists or other professionally trained support staff would be a valuable asset in this respect because young athletes may benefit from sharing their thoughts and worries with an impartial professional who is not directly involved. If the goal is to raise capable, resilient high performance athletes, mental health care is indispensable during the formative years of adolescence.

6. Conclusion

By being the first to apply a contrast group analysis in this thematic field, we were able to identify certain features that characterize high and low burner profiles. In addition, we found feature combinations that indicate heightened risk of ABO as well as feature combinations that are likely to protect athletes from developing burnout. Through our study we aim to provide a comprehensive empirical base for hypothesis-testing follow-up studies, which is essential to further decipher the mechanisms of ABO development and, above all, to ensure the physical and mental well-being of young athletes within elite sport. The large sample size can be acknowledged as a particular strength: It provides a substantial base for analyses that can aid the development of prevention and treatment programs, inspire further research in the field, and educate athletes, coaches, staff, association officials, and other practitioners in the field of young elite sport on the topic of ABO.

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Appendix

Table A1

Classification tree path description, number of cases and mean score for the symptom Burnout-EXH for the terminal nodes with the highest and lowest mean score.

Node	Description	N	Size	Mean (SD)
16	High subjective stress outside of sport (> 3.3), type of sport (technical, endurance, aesthetic, weight dependent)	57	5%	3.13 (0.87)
6	Low subjective stress outside of sport (≤ 1.3), less weekly hours of training (≤ 10)	50	5%	1.47 (0.44)

Table A2

Classification tree path description, number of cases and mean score for the symptom Burnout-RA for the terminal nodes with the highest and lowest mean score.

Node	Description	N	Size	Mean (SD)
10	High expectancy of negative reaction to pain communication (> 2), gender (female)	123	11%	2.40 (0.65)
13	Low expectancy of negative reaction to pain communication (≤ 1), high health satisfaction (> 4), low subjective stress outside of sport (≤ 2.3)	168	15%	1.68 (0.50)

Table A3

Classification tree path description, number of cases and mean score for the symptom Burnout-DEV for the terminal nodes with the highest and lowest mean score.

Node	Description	N	Size	Mean (SD)
11	Lower willingness to make psycho-social sacrifices (1.67–2.67), coach's style of leadership (autocratic, laissez-faire), less hours of sleep (< 6)	70	6%	2.28 (0.77)
14	Higher willingness to make psycho-social sacrifices (2.67–4), low expectancy of negative reaction to pain communication (≤ 1), low subjective stress outside of sport (≤ 2.3)	184	17%	1.35 (0.38)

References

- Ahola, K., Hakonen, J., Perhoniemi, R., & Mutanen, P. (2014). Relationship between burnout and depressive symptoms: A study using the person-centred approach. *Burnout Research*, 1(1), 29–37.
- Alkhasawneh, M. S., Ngah, U. K., Tay, L. T., Mat Isa, N. A., & Al-Batah, M. S. (2014). Modeling and testing landslide hazard using decision tree. *Journal of Applied Mathematics*(9).
- Becker, P. (2003). Anforderungs-Ressourcen-Modell in der Gesundheitsförderung. *Leitbegriffe der Gesundheitsförderung*, 4, 13–15.
- Becker, P., Schulz, P., & Schlotz, W. (2004). Persönlichkeit, chronischer Stress und körperliche Gesundheit: Eine prospektive Studie zur Überprüfung eines systemischen Anforderungs-Ressourcen-Modells. *Zeitschrift für Gesundheitspsychologie*, 12, 11–23.
- Bianchi, R., Schonfeld, I. S., & Laurent, E. (2015). Burnout-depression overlap: A review. *Clinical Psychology Review*, 36, 28–41.
- Brennkemeyer, V., Van Yperen, N. W., & Buunk, B. P. (2001). Burnout and depression are not identical twins: Is decline of superiority a distinguishing feature? *Personality and Individual Differences*, 30, 837–880.
- Brettschneider, W. D. (1999). Risks and opportunities: Adolescents in top-level sport growing up with the pressures of school and training. *European Physical Education Review*, 5(2), 121–133.
- Brinton, C. S., Hill, B. J., & Ward, P. J. (2017). Authoritative coach: Building youth through sport. *Journal of Park and Recreation Administration*, 35(1), 51–65.
- Bühl, A. (2012). *SPSS 20 - Einführung in die moderne Datenanalyse 13*. Harlow: München.
- Camp, N., & Slattery, M. (2002). Classification tree analysis: A statistical tool to investigate risk factor interactions with an example for colon cancer (United States). *Cancer Causes & Control*, 13, 813–823.
- Cassidy, T., Jones, R., & Potrac, P. (2009). *Understanding sports coaching. The social, cultural and pedagogical foundations of coaching practice*. New York, NY: Routledge.
- Chen, J. A., Shih, C. C., Lin, P. F., Chen, J. J., & Lin, K. C. (2012). Collaborative evaluation and management of students' health-related physical fitness: Applications of cluster analysis and the classification tree. *International Journal of Adolescent Medicine and Health*, 24(2), 153–159.
- Cherniss, C. (1980). *Staff burnout: Job stress in the human services*. Beverly Hills, CA: Sage Publications.
- Coakley, J. (1992). Burnout among adolescent athletes: A personal failure or social problem? *Sociology of Sport Journal*, 9, 271–285.
- Coleman, J. (2011). *The nature of adolescence*. Routledge.
- Cresswell, S. L., & Eklund, R. C. (2006a). Changes in athlete burnout over a thirty-week "rugby year". *Journal of Science and Medicine in Sport*, 9, 125–134.
- Cresswell, S. L., & Eklund, R. C. (2006b). Athlete burnout: Conceptual confusion, current research and future research directions. *Literature Reviews in Sport Psychology*, 91–126.
- Curran, T., Appleton, P. R., Hill, A., & Hall, H. K. (2011). Passion and burnout in elite junior soccer players: The mediating role of self-determined motivation. *Journal of Psychology of Sport and Exercise*, 12(6), 655–661.
- Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology*, 49, 182–185.
- Diehl, K., Thiel, A., Zipfel, S., Mayer, J., & Schneider, S. (2012). Substance use among elite adolescent athletes: Findings from the GOAL study. *Scandinavian Journal of Medicine and Science in Sports*. <https://doi.org/10.1111/j.1600-0838.2012.01472.x>
- Dubuc-Charbonneau, N., Durand-Bush, N., & Forneris, T. (2014). Exploring levels of student-athlete burnout at two Canadian universities. *Canadian Journal of Higher Education*, 44(2), 135–151.
- Durand-Bush, N., Salmela, J. H., & Green-Demers, I. (2001). The Ottawa mental skills assessment tool (OMSAT-3*). *The Sport Psychologist*, 15(1), 1–19.
- Eklund, R. C., & DeFreese, J. D. (2015). Athlete Burnout: What we know, what we could know, and how we can find out more. *International Journal of Applied Sports Sciences*, 27(2), 63–75.
- Gerber, M., Best, S., Meerstetter, F., Walter, M., Ludyga, S., Brand, S., et al. (2018b). Effects of stress and mental toughness on burnout and depressive symptoms: A prospective study with young elite athletes. *Journal of Science and Medicine in Sport*, 21(12), 1200–1205.
- Gerber, M., Gustafsson, H., Seelig, H., Kellmann, M., Ludyga, S., Colledge, F., et al. (2018a). Usefulness of the Athlete Burnout Questionnaire (ABQ) as a screening tool for the detection of clinically relevant burnout symptoms among young elite athletes. *Psychology of Sport and Exercise*, 39, 104–113.
- Goodger, K., Gorely, T., Lavallee, D., & Harwood, C. (2007). Burnout in sport: A systematic review. *The Sport Psychologist*, 21, 127–151.
- Gould, D., & Dieffenbach, K. (2002). Overtraining, underrecovery, and burnout in sport. In M. Kellmann (Ed.), *Enhancing recovery: Preventing underperformance in athletes* (pp. 25–35). Champaign, IL: Human Kinetics.
- Gould, D., Udry, E., Tuffey, S., & Loehr, J. (1997). Burnout in competitive junior tennis players: III. Individual differences in the burnout experience. *The Sport Psychologist*, 11(3), 257–276.
- Gustafsson, H., DeFreese, J. D., & Madigan, D. J. (2017). Athlete burnout: Review and recommendations. *Current opinion in Psychology*, 16, 109–113.
- Gustafsson, H., Hassmen, P., & Hassmen, N. (2011b). Are athletes burning out with passion? *European Journal of Sport Science*, 11(6), 387–395.
- Gustafsson, H., Kenttä, G., & Hassmen, P. (2011a). Athlete burnout: An integrated model and future research directions. *International Review of Sport and Exercise Psychology*, 4, 3–24.
- Gustafsson, H., Kenttä, G., Hassmen, P., & Lundqvist, C. (2007). Prevalence of burnout in adolescent competitive athletes. *The Sport Psychologist*, 21(1), 21–37.
- Gustafsson, H., Madigan, D. J., & Lundqvist, E. (2018). Burnout in athletes. In R. Fuchs, & M. Gerber (Eds.), *Handbuch Stressregulation und Sport* (pp. 489–504). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Gustafsson, H., & Skoog, T. (2012). The mediational role of perceived stress in the relation between optimism and burnout in competitive athletes. *Anxiety, Stress & Coping*, 25(2), 183–199.
- Harris, B. S., & Ostrow, A. C. (2008). Coach and athlete burnout: The role of coaches' decision-making style. *Sports and Athletics Developments*, 81–100.
- Harris, B. S., & Watson, J. C. (2011). Assessing youth sport burnout: A self-determination and identity development perspective. *Journal of Clinical Sport Psychology*, 5(2), 117–133.
- Havighurst, R. J. (1956). Research on the developmental-task concept. *The School Review*, 64, 215–223.
- Heidari, S. (2013). Gender differences in burnout individual athletes. *European Journal of Experimental Biology*, 3(3), 583–588.
- Hill, A., & Curran, T. (2016). Multidimensional perfectionism and burnout: A meta-analysis. *Personality and Social Psychology Review*, 20(3), 269–288.
- Hill, A., Hall, H., & Appleton, P. R. (2010). Perfectionism and athlete burnout in junior elite athletes: The mediating role of coping tendencies. *Journal of Anxiety, Stress and Coping*, 23(4), 415–430.
- Hodge, K., Lonsdale, C., & Ng, J. Y. Y. (2008). Burnout in elite rugby: Relationships with basic psychological needs fulfilment. *Journal of Sports Science*, 26(8), 835–844.
- Hoffmann, K., Sallen, J., Albert, K., & Richartz, A. (2012). Chronisches Belastungserleben von Spitzensportlern. Welche Rolle spielen soziodemographische und sportliche Rahmenbedingungen? In I. Pfeffer, & D. Alfermann (Eds.), *Menschen in Bewegung - Sportpsychologie zwischen Tradition und Zukunft*. Hamburg: Czwalina.
- Isaard-Gauthier, S., Guillet-Descas, E., & Gustafsson, H. (2016). Athlete burnout and the risk of dropout among young elite handball players. *The Sport Psychologist*, 30(2), 123–130.
- Isaard-Gauthier, S., Guillet-Descas, E., & Lemyre, P. N. (2012). A prospective study of the influence of perceived coaching style on burnout propensity in high level young athletes: Using a self-determination theory perspective. *The Sport Psychologist*, 26(2), 282–298.
- Kallus, K. W., & Kellmann, M. (2000). Burnout in athletes and coaches. In Y. L. Hanin (Ed.), *Emotions in sport* (pp. 209–230). Champaign, IL: Human Kinetics.
- Kenttä, G., & Hassmen, P. (1998). Overtraining and recovery: A conceptual model. *Sports Medicine*, 26, 1–16.
- Kenttä, G., Hassmen, P., & Raglin, J. S. (2001). Training practices and overtraining syndrome in Swedish age-group athletes. *International Journal of Sports Medicine*, 22, 460–465.
- Knight, C. J., Berrow, S. R., & Harwood, C. G. (2017). Parenting in sport. *Current Opinion in Psychology*, 16, 93–97.
- Krippel, M., & Ziemainz, H. (2010). Burnout as a psychological disorder in competitive athletics. *Advances in Psychological Research*, 69, 177–192.
- Laursen, B. P., & Hoff, E. (2006). Person-centered and variable-centered approaches to longitudinal data. *Merrill-Palmer Quarterly*, 52(3), 377–389.
- Lemon, S., Roy, J., Clark, M., Friedmann, P., & Rakowski, W. (2003). Classification and regression tree analysis in public health: Methodological Review and comparison with logistic regression. *Annals of Behavioral Medicine*, 26(3), 172–181.
- Lemyre, P. N., Hall, H. K., & Roberts, G. C. (2008). A social-cognitive approach to burnout in elite athletes. *Scandinavian Journal of Medicine & Science in Sports*, 18, 221–234.
- Lemyre, P. N., Treasure, D., & Roberts, G. (2006). Influence of variability in motivation and affect on elite athlete burnout susceptibility. *Journal of Sport & Exercise Psychology*, 28, 32–48.
- Li, C., Wang, C. J., & Kee, Y. H. (2013). Burnout and its relations with basic psychological needs and motivation among athletes: A systematic review and meta-analysis. *Psychology of Sport and Exercise*, 14, 692–700.
- Lundkvist, E., Gustafsson, H., Davis, P. A., Holmström, S., Lemyre, P. N., & Ivarsson, A. (2017). The temporal relations across burnout dimensions in athletes. *Scandinavian Journal of Medicine & Science in Sports*, 28(3), 1215–1226.
- Lupien, S. J., McEwen, B. S., Gunnar, M. R., & Heim, C. (2009). Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nature Reviews Neuroscience*, 10(6), 434–445.
- Malcolm, N. L. (2006). "Shaking it off" and "Toughing it out" - socialization to pain and injury in girl's softball. *Journal of Contemporary Ethnography*, 35(5), 495–525to.
- Malina, R. M. (2002). The young athlete: Biological growth and maturation in a bio-cultural context. In F. L. Smoll, & R. E. Smith (Eds.), *Children and youth sport: A biopsychosocial perspective* (pp. 261–292). Dubuque, IA: Kendall/Hunt.
- Maslach, C., Jackson, S. E., & Leiter, M. P. (1996). *The Maslach burnout inventory manual* (2nd ed.,). Palo Alto, CA: Consulting Psychologists Press.
- Maslach, C., & Leiter, M. P. (2000). Burnout. In E. Fink (Ed.), *Encyclopedia of stress* (pp. 358–362). New York: Academic Press.
- Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annual Review of Psychology*, 52, 397–422.
- Mayer, J., & Thiel, A. (2014). Health in elite sports from a salutogenetic perspective: Athletes' sense of coherence. *PLoS One*, 9(7), e102030.
- Mitchell, T. O., Nesti, M., Richardson, D., Midgley, A. W., Eubank, M., & Littlewood, M. (2014). Exploring athletic identity in elite-level English youth football: A cross-sectional approach. *Journal of Sports Sciences*, 32(13), 1294–1299.
- Naughton, G., Farpour-Lambert, N., Carlson, J., Bradney, M., & Van Praagh, E. (2000). Physiological issues surrounding the performance of adolescent athletes. *Sports Medicine*, 30, 309–325.
- Ohlert, J. (2013). Konzeption und Evaluation einer sportpsychologischen Lehrgangsbetreuung im Mädchenfußball. *Leistungssport*, 43(37–42).
- Ohlert, J., & Kleintner, J. (2014). Entwicklungsaufgaben jugendlicher Elite-Handballerinnen und -Handballer. *Zeitschrift für Sportpsychologie*, 21(4), 161–172.
- Ommundsen, Y., Roberts, G. C., Lemyre, P.-N., & Miller, B. W. (2006). Parental and coach

- support or pressure on psychosocial outcomes of pediatric athletes in soccer. *Clinical Journal of Sport Medicine*, 16(6), 522–526.
- Pelka, M., & Kellmann, M. (2017). Understanding underrecovery, overtraining, and burnout in the developing athlete. In J. Baker, S. Copley, J. Schorer, & N. Wattie (Eds.). *Routledge handbook of talent identification and development in sport*. New York: Routledge.
- Pines, A. M. (1993). Burnout: An existentialistic perspective. In W. B. Schaufeli, C. Maslach, & T. Marek (Eds.). *Professional burnout: Developments in theory and research*. Taylor & Francis.
- Raedeke, T. D. (1997). Is athlete burnout more than just stress? A sport commitment perspective. *Journal of Sport & Exercise Psychology*, 19(4), 396–417.
- Raedeke, T. D., & Smith, A. L. (2001). Development and preliminary validation of an athlete burnout measure. *Journal of Sport & Exercise Psychology*, 23, 281–306.
- Raedeke, T. D., & Smith, A. L. (2004). Coping resources and athlete burnout: An examination of stress mediated and moderation hypotheses. *Journal of Sport & Exercise Psychology*, 26(4), 525–541.
- Raedeke, T. D., & Smith, A. L. (2009). *The athlete burnout questionnaire manual*. Morgantown, WV: Fitness Information Technology.
- Sanders, G., & Stevinson, C. (2017). Associations between retirement reasons, chronic pain, athletic identity, and depressive symptoms among former professional footballers. *European Journal of Sport Science*, 17(10), 1311–1318.
- Santrock, J. W. (2004). *Life-span development*. New York: McGraw-Hill.
- Schaufeli, W. B., & Buunk, B. P. (2003). Burnout: An overview of 25 years of research and theorizing. In M. J. Schabracq, J. A. M. Winnubst, & C. L. Cooper (Eds.). *The handbook of work and health psychology* (pp. 383–425). London: Wiley.
- Schnell, A., Mayer, J., Diehl, K., Zipfel, S., & Thiel, A. (2014). Giving everything for athletic success! - Sports-specific risk acceptance of elite adolescent athletes. *Psychology of Sport and Exercise*, 15(2), 165–172.
- Schubring, A. (2014). *Wachstum als Herausforderung - soziologische Analysen des Wachstumsmanagements jugendlicher Spitzensportler und Nachwuchstrainer*. Tübingen: Eberhard Karls Universität Tübingen.
- Schubring, A., Bub, E.-M., & Thiel, A. (2015). "How much is too much?" The social construction of elite youth athlete exercise tolerances from the coaches' perspective. *Journal of Sport and Social Issues*, 39(4), 308–331.
- Sharp, L.-A., Woodcock, C., Holland, M. J., Duda, J. L., & Cumming, J. (2010). Validation of the athlete burnout questionnaire with youth athletes. *Journal of Sport & Exercise Psychology*, 32, 218–219.
- Sheard, M., & Golby, J. (2006). Effect of a psychological skills training program on swimming performance and positive psychological development. *International Journal of Sport and Exercise Psychology*, 4(2), 149–169.
- Smith, R. E. (1986). Towards a cognitive-affective model of athlete burnout. *Journal of Sport Psychology*, 8, 36–50.
- Smith, A. L., Gustafsson, H., & Hassmen, P. (2010). Peer motivational climate and burnout perceptions of adolescent athletes. *Psychology of Sport and Exercise*, 11(6), 453–460.
- Sportbund, D. (2003). *Qualitätskriterien der Eliteschulen des Sports*. Frankfurt am Main: Deutscher Sportbund.
- Sundgot-Borgen, J., & Torstveit, M. K. (2004). Prevalence of eating disorders in elite athletes is higher than in the general population. *Clinical Journal of Sport Medicine*, 14(1), 25–32.
- Tamminen, K. A., Holt, N. L., & Crocker, P. R. E. (2012). Adolescent athletes: Psychosocial challenges and clinical concerns. *Current Opinion in Psychiatry*, 25(4), 293–300.
- Teubert, H., Cachay, K., Borggreffe, C., & Thiel, A. (2006). *Spitzensport und Schule - Möglichkeiten und Grenzen struktureller Kopplung in der Nachwuchsförderung*. Schondorf: Hofmann.
- Thiel, A., Diehl, K., Giel, K. E., Schnell, A., Schubring, A. M., Mayer, J., et al. (2011). The German young olympic athletes' lifestyle and health management study (GOAL study): Design of a mixed-method study. *BMC Public Health*, 11, 410. <https://doi.org/10.1186/1471-2458-11-410>.
- Ziemainz, H., Abu-Omar, K., Raedeke, T., & Krause, K. (2004). Burnout im Sport. Zur Prävalenz von Burnout aus bedingungsbezogener Perspektive. *Leistungssport*, 34(6), 12–17.