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Student-athletes' mood state profiles: The role of sports, sex, and performance level in sports and in school

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The dataset analyzed in the present study is available from the corresponding author upon reasonable request.

Abstract

Daily workloads of adolescent student-athletes can be extremely high because of their investment in both school and sport. Adolescents are especially vulnerable to mood disturbances and disorders and thus mental health problems, as they experience psychological, physiological, and social shifts at this key stage of human development. The present study aims to provide information on the mental health of Finnish high school athletes by investigating their mood state profiles and the potential associations of sex, type of sport, and level of performance in sports and school with those profiles. Data were gathered through an online survey of 444 male and female student-athletes (aged 16–17) during the spring term of their second grade of high school. The 37-item Profile of Mood States questionnaire was used to measure mood states, with four mood state profiles found: (1) the *surface* profile (39.8%), (2) the *Everest* profile (13.2%), (3) the *inverse Everest* profile (13.2%), and (4) the *iceberg* profile (33.8%). Of the background variables, only sex was found to be related with the mood state profiles, with the Everest profile much more common in males (74.2%) than in females (25.8%). In addition, the energy index and total mood disturbance of mood states were higher among males than among females. The findings indicate that it is important to pay special attention to the mood states of young student-athletes, particularly females, and to create support systems that foster their resilience in combining sport and studies.

Keywords: *student-athletes, dual career, mood states, adolescent, mental well-being, mood profile*

Lay summary: This study explores mood in adolescent student-athletes in terms of mood state profiles, total mood disturbance, and energy index. Profile of Mood State (POMS) metrics were used to determine mood state profiles; POMS has previously been found to be a valid indicator of the state of athletes' mental health.

IMPLICATIONS FOR PRACTICE

- There is a need to pay special attention to adolescent female student-athletes' coping and resilience when combining school and sport.
- Fatigue may be a notable impairing factor concerning student-athletes' academic performance at school.
- POMS is a valid and recommendable tool to monitor and measure the mood state of athletes.

Student-athletes' mood state profiles: The role of sports, sex, and performance level in sports and school

High school athletes need to invest in sports and studies at the same time, and both activities demand substantial amounts of mental resources. The combination of sports and school has been defined as a dual career (European Commission, 2012). High school studies may bring a suitable counterbalance to sports by offering other things on which to focus, but they are also an additional load for the student-athlete (Sorkkila et al., 2020). At high school age, many athletes begin to seriously pursue a career as an elite or professional athlete (Ryba et al., 2016). However, investing in and concentrating on both sports and school exposes the individual to multiple stressors, such as academic and athletic pressure, injuries, burnout, and critical evaluation of performance (Beauchemin, 2012; Brown, 2014), which can sap the mental resources of young people and, in extreme cases, completely exhaust them. At its worst, mental exhaustion may cause substance use, other mental health problems, and social anxiety (Ryan et al., 2018).

An individual's mood—that is, emotional state—has been shown to be central to psychological health (for a review, see Diener et al., 2015), and disturbances in mood can lead to subsequent psychological maladjustment (Waraich et al., 2004). Therefore, knowledge regarding adolescent athletes' mood state profiles and the different factors related to those profiles is crucial when seeking to understand the possible risks and protective factors of dual career development. Only a few studies on mood states among adolescent student-athletes have been carried out, and most of them were conducted with English-speaking participants (Nixdorf et al., 2016; Pluhar et al., 2019; Reynoso-Sánchez et al., 2021; Schaal et al., 2011). Consequently, the present study aimed to investigate the mood state profiles of adolescent student-athletes and the potential associations of various background variables with those profiles.

Mood states

By definition, mood refers to an emotional *state* that is more like a general feeling and less specific than emotions or affects; moods are less likely to emerge from a particular event or stimulus than emotions (Schinnerer, 2007); they are also less intense but more temporally durable than emotions (Berger & Motl, 2000). Moods and emotions are connected, so that negative and positive moods initiate negative and positive emotions, respectively (Thagard, 2018). Personality and circumstances are among the many factors that influence mood intensity (Terry, 1995). Mood disorders like depression and anxiety are mental health problems that can develop into chronic disorders, resulting in a poorer quality of life (Paus et al., 2008).

Profiles of mood states in athletes

Research carried out among athletes has demonstrated that mood is an important factor in psychological well-being (Kenttä et al., 2006). One frequently used measure to assess athletes' mood states is the Profile of Mood States (POMS) questionnaire (McNair, Lorr & Droppleman, 1971). It has been used in clinical settings (Terry, 1995) and to determine athletes' susceptibility to exhaustion and overtraining syndrome (OTS), a condition with extreme maladapted physiology resulting from excessive exercise and inadequate rest (Carrard et al., 2021; Kreher, 2016) and their risk of injury (Curran et al., 1995). According to Meeusen et al. (2013), when reduced performance capacity lasts for more than four weeks and is not followed by either supercompensation or improved athletic performance, the athlete is prone to OTS. Acute fatigue that results from one training session or a series of such sessions is part of a normal training program, but inadequate recovery can lead to a continuum of short-term performance decrements and, at worst, to OTS (Meeusen et al., 2013).

Although there are other measures that assess mood states, the POMS is one of the most widely used in different populations, especially among athletes, and is a practical tool for monitoring health condition, recovery, and the effects of training (Selänne et al., 2013). In the present study, we applied the POMS in a sample of dual career athletes. The previous research on the topic has been carried out among athletes in general, but it is reasonable to assume that athletes in dual careers may be especially prone to exhaustion and related mood states because of the pressures of combining sport and education. For example, Larsen and Kuettel (2019) found that student-athletes aged 17–21 showed more symptoms of anxiety and depression than both younger and older athletes. In that age range, they averaged 26 study-related hours and 20 hours of training per week (Larsen & Kuettel, 2019). Clearly, the dual career athlete's rest and recovery may be compromised because of limited time.

The standard POMS scoring produces a global distress score, the total mood disturbance (TMD), and scores for six subscales: fatigue-inertia, vigor-activity, tension-anxiety, depression-dejection, anger-hostility, and confusion-bewilderment (Curran et al., 1995). The sum of the five negative POMS items (depression, anger, confusion, fatigue, and tension) minus vigour is used to calculate the TMD score, which can be used as an indicator of overtraining and recovery. The ratio of POMS vigor to POMS fatigue, meanwhile, is translated into an energy index (EI) (Kenttä et al., 2006) and can be used to observe the effects of training and recovery (Selänne et al., 2013). For example, Box et al. (2018) found the EI to be negatively associated with acute fatigue for athletes during a five-week CrossFit Open™ competition. It was also negatively associated with the fatigue-inertia subscale.

Metrics other than the POMS are also used to measure mood states, including the Brunel Mood Scale (BRUMS), derived from the POMS (de Miranda Rohlfs et al., 2008). BRUMS measures the same six moods as the POMS but uses fewer items to do so. Terry and Parsons-Smith (2021) demonstrated by applying BRUMS that profiling the six mood

dimensions (i.e., scores of subscales) resulted in a graphic profile that identifies common patterns of mood responses (see examples at the top of Figure 1). The literature indicates that successful and mentally healthy athletes demonstrate a positive mood profile; that is, an *iceberg* profile characterized by a high level of vigor and low levels of confusion, depression, anger, fatigue, and tension (Terry, 1995). Meanwhile, the *inverse iceberg* profile (low level of vigor and high levels of confusion, depression, anger, fatigue, and tension) has been associated with OTS (Correia et al., 2016) and mental dysfunction (Terry, 1995). A third profile, the *Everest* profile, occurs when the gap between vigor and negative mood dimensions is even wider than in the iceberg profile: the level of vigor is higher and tension, depression, anger, fatigue, and confusion levels lower than in the iceberg profile (Terry & Parsons-Smith, 2021). The Everest profile has been found to apply to superior athletic performance (Terry, 1995). Research has shown that mood profiles of athletes typically differ from the general (non-athlete) population, so athletes are more likely to fit the iceberg profile (Terry & Parsons-Smith, 2021).

In a recent study, Terry and Parsons-Smith (2019) reported four additional mood state profiles (a graphic presentation of these profiles appears in the top half of Figure 1): (a) the *inverse Everest* profile, characterized by low vigor, high tension and fatigue, and very high depression, anger, and confusion; (b) the *shark fin* profile, characterized by below-average tension, depression, anger, vigor, and confusion and high fatigue; (c) the *surface* profile, characterized by average scores for all mood dimensions; and (d) the *submerged* profile, as characterized by below-average scores for all mood dimensions. In a study carried out among 3,661 adult athletes, Terry, and Parsons-Smith (2019) found that the iceberg profile applied to 30%, the inverse iceberg profile to 14%, the inverse Everest profile to 5%, the shark fin profile to 13%, the submerged profile to 18%, and the surface profile to 21%. Cross-cultural

research has demonstrated similar profiles in Singaporean (Han et al., 2020), Italian (Quartiroli et al. 2018), and Malaysian (Lan et al., 2012) populations.

Mood profiling has been identified as a valuable tool for screening post-traumatic stress risk, adolescent suicide risk, and the risk of eating disorders (Terry & Galambos, 2004), along with monitoring psychological responses to travel fatigue and jet lag (Terry & Lane, 2011). In general, the inverse iceberg and inverse Everest profiles are related to negative mental health outcomes, whereas the iceberg and Everest profiles are related to positive psychological health.

The role of background variables in athletes' mood states

A number of background factors have been associated with athletes' mood states, including sex (Abbas et al., 2020; Reynoso-Sánchez et al., 2021; Terry & Lane, 2000; Terry & Parsons-Smith, 2021), level of performance in sports (Renger, 1993) and in school (Terry et al., 2021; Thelwell et al., 2007), and type of sport (Nixdorf et al., 2016; Pluhar et al., 2019; Reynoso-Sánchez et al., 2021; Schaal et al., 2011). Commonly, females tend to report higher values for negative mood dimensions and lower values for vigor than males. For example, Abbas et al. (2020) and Reynoso-Sánchez et al. (2021) found that female athletes scored lower in vigor and higher in all other mood dimensions than their male counterparts. These studies were carried out among adult elite athletes and youth athletes, respectively. In contrast, in a study by Terry and Lane (2000), carried out among adult athletes from different competition levels, mood states differed between the sexes only in regard to tension, which was higher among female than among male athletes. In the study by Terry and Parsons-Smith (2021), female athletes scored higher for tension, fatigue, and confusion, while male athletes scored significantly higher for anger and vigor, and no gender differences were found for depression. Overall, it has been suggested that sex differences in brain structure and function, such as

those that promote reproductive function, may make females more prone to negative moods and therefore to mood and anxiety disorders (Altemus et al., 2014).

In addition, differences have been found in athletes' mood states by type of sport. Athletes in individual sports tend to score higher for tension, depression, confusion, anger, and fatigue and lower for vigor than athletes in team sports (Reynoso-Sánchez et al., 2021). Nixdorf and colleagues (2016) found that junior athletes who were engaged in individual sports had higher depression scores than their team sport peers. In addition, Schaal et al. (2011) noted that depressive symptoms occurred in 24% of aesthetic sport athletes and 18% of fine motor skill sport athletes, compared to 8% of team sport athletes. A more recent study also showed that significantly more individual sport athletes (13%) suffered from anxiety and depression than team sport athletes (7%) (Pluhar et al., 2019). One reason may be that when failure happens, athletes in individual sports internalize all the blame and shame that may be involved, while the cause of failure in team sports is shared among several or even many athletes so that negative emotions are not internalized as deeply (Hanrahan & Cerin, 2009). Team sports also offer a better social atmosphere that is (ideally) characterized by a sense of community and relationships with more peers, which create feelings of comfort and acceptance that can minimize insecurities and emotional problems (Boone & Leadbeater, 2006; Eime et al., 2013).

Another factor that has been studied in relation to mood states is athletes' level of sport performance. Athletes at a high competition level—that is, elite athletes at the international level—tend to show more positive mood states than recreational athletes (Renger, 1993). Furthermore, higher academic performance levels have been shown to be related to the iceberg profile (Thelwell et al., 2007). In line with this, Terry et al. (2021) found that higher education levels among non-athlete participants were associated with more positive moods; they suggested that this finding could be due to the fact that education

develops higher-level skills and may lead to higher employment rates, greater productivity, and more lifetime earnings, all of which impact general health and thus lead to better moods.

Overall, the existing literature suggests that mood states may play a role in student-athletes' sport and school performance and in their well-being. In addition, a number of background variables have been associated with mood states among athletes. Those previous studies, however, have some limitations. First, most studies focus on English-speaking cohorts rather than other cultures. Second, they have examined different mood state variables rather than mood state profiles when examining the role played by background variables in mood states. According to theoretical developments, when applying a person-oriented approach to mood state (i.e., by focusing on individual profiles rather than specific variables), it is important to assess the mental health of an individual athlete and compare it with that individual's earlier profile and with the profiles of other athletes (Terry & Parsons-Smith, 2021). Finally, previous studies have generally considered adult athletes, so there is a lack of knowledge concerning the associations of mood state profiles with sex, type of sport, and performance level in sports and in school among adolescent student-athletes. Adolescents are especially predisposed to mood disturbances and disorders and are thus at greater risk of mental health problems because they experience more psychological, physiological, and social shifts at this developmental stage (Paus et al., 2008).

Purpose of the present study

The aim of the present study was to investigate Finnish high school athletes' mood states and how different background variables are associated with them. Two approaches to mood states were applied. First, adopting a person-oriented approach, the following research questions were posed:

1) What kinds of mood state profiles can be found among high school student-athletes, and how typical are the different profiles among that population?

2) To what extent are sex, type of sport, and school achievement in terms of grade point average, and level of performance in sports associated with the identified profiles? Second, following a variable-oriented approach, we posed the following research questions:

3) To what extent are sex, type of sport, grade point average, and level of performance in sports and the interaction of these factors related to total mood disturbance as measured by the Profile of Mood State tool?

4) To what extent are sex, type of sport, grade point average, and level of performance in sports and the interaction between these factors with the energy index as measured by the Profile of Mood State tool?

We hypothesized, first, that different mood state profiles found in previous studies would be evident in the sample, including the iceberg profile, the inverse iceberg profile, the Everest profile, and the inverse Everest profile (H1). However, as no previous studies were carried out among high school student-athletes, we did not propose any hypotheses regarding the typicality or frequency of the different profiles. Second, we hypothesized that student-athletes with high performance levels academically (Thelwell et al., 2007) and competitively (Renger, 1993) would have more positive mood state profiles (iceberg or Everest profile), TMDs, and EIs than student-athletes with low performance levels (H2). Furthermore, we hypothesized that females (Abbas et al., 2020) and individual sport athletes (Reynoso-Sánchez et al., 2021) would have more negative mood state profiles (inverse iceberg profile or the inverse Everest profile), TMDs and EIs than males and team sport athletes, respectively (H3).

Method

Sample and procedure

This research is based on data collected by the Winning in the Long Run project (Ryba et al., 2016). The participants in the present study were second-year student-athletes (aged 16–17)

enrolled at seven upper secondary sport schools across the Northern, Central, and Southern parts of Finland. The sample consisted of 444 adolescents (51% female), with 47% engaged in individual sports and 53% in team sports. The participants' grade point average (GPA, which ranges from 4 to 10 in the Finnish system) averaged 8.01 (*SD* = 0.92). Demographical information on the sample is summarized in the table in Supplementary Material S1. The data were gathered using web surveys supported by the Webropol software. Measurements took place in the spring term of the second grade of high school. Approval was obtained from the ethics committee of the University of Jyväskylä. The procedures used in this study adhere to the tenets of the Declaration of Helsinki. Informed consent was obtained from all participants; in Finland, informed consent from the guardians of young people over 15 is not required.

Measurements

Background variables

In this study, we used biological sex (evaluated with a dichotomous variable: 1 = female, 2 = male), type of sport, level in sport, and level in school (as measured by GPA) as background variables. Type of sport was evaluated by asking participants to indicate their sport from a list containing a total of 86 Olympic, Paralympic, and non-Olympic sports. The answers were coded for two categories: individual sports (e.g., cross-country skiing, swimming, athletics) and team sports (e.g., football [soccer], ice hockey, basketball). Level of performance in sports was assessed by querying the student's highest competition level in the previous year (0 = regional competitions or games to 14 = Olympic Games). Level of performance in school was assessed by asking participants to report their most recent high school GPA (range 4 to 10).

Mood states

Mood states were measured with the 37-item POMS questionnaire (POMS-SF; Curran et al., 1995), which was translated into Finnish. Respondents reported the degree to which each presented item described themselves during the previous week, using a five-point Likert-type scale (1 = *not at all*, 5 = *extremely*). Standard POMS scoring yields the global distress score, the TMD, along with scores for six subscales: fatigue-inertia (five items), vigor-activity (six items), tension-anxiety (six items), depression-dejection (eight items), anger-hostility (seven items), and confusion-bewilderment (five items). The Cronbach's alphas of the TMD and subscales were all satisfactory (.89 for TMD, .84 for depression, .85 for tension, .85 for anger, .91 for vigor, .87 for confusion, and .87 for fatigue). The Finnish version of the POMS-SF has been standardized to that country's conditions by the Occupational Health Institute (Hänninen, 1989).

Statistical analyses

The statistical analyses were carried out as follows. First, latent profile analysis (LPA) was used to identify homogeneous subgroups (i.e., profiles) of student-athletes' mood states using the six mood state dimensions as indicator variables. LPA is a person-centered method that aims to identify naturally occurring latent subpopulations that demonstrate different configurations on a certain set of criteria variables (Mäkikangas et al., 2018). By examining the covariance structure of the six mood state dimensions through differences in their mean values between the latent subpopulations rather than through the associations between continuous variables, LPA made it possible to identify naturally occurring subpopulations of student-athletes demonstrating different mood state profiles—without knowing the number of those subpopulations beforehand—and to examine the typicality of different profiles in the sample. Estimation was performed in stages, starting with a one-class solution and continuing to estimate the parameters for two- to seven-class solutions. To ensure the validity of each class solution, several starting values were used for the parameters.

The following statistical criteria were used to evaluate the fit of the different profile solutions: (a) log likelihood (Log L); (b) Akaike's information criterion (AIC); (c) the sample-size adjusted Bayesian information criterion (aBIC); (d) the Lo-Mendell-Rubin adjusted likelihood ratio test (LMR); (e) the reliability of classification by entropy; and (f) the average latent class posterior probabilities (AvePP; Muthén & Muthén, 1998–2010). The lower the absolute value of Log L, AIC, and aBIC, the better the model fit. The LMR test compares solutions with different numbers of latent profiles. A low p value ($p < .05$) suggests that a solution with k latent profiles fits the data better than a solution with k-1 profile. The entropy and AvePP indices assess the statistical quality of the classification (i.e., how well the model classifies individuals into subgroups), with possible values ranging from zero to one. As a rule of thumb, values > 0.70 indicate that the solution found is interpretable using the mean trajectories (Nagin, 2005).

Second, differences between the identified POMS profiles in background variables (sex, type of sport, GPA, and level in sport) were investigated by including the background variables in the previous model as auxiliary indicator variables, in line with the auxiliary measurement-error-weighted method (Asparouhov & Muthén, 2021), which enables the testing of differences between the latent profiles in external variables (i.e., auxiliary variables) with a chi-square test and without letting these external variables affect the formation of the latent profiles (Korpipää et al., 2020). To estimate the mean of the continuous auxiliary variables (i.e., GPA and level of sport) in the profiles, the Bolck-Croon-Hagenaars (BCH; Bakk & Vermunt, 2016) method was applied in estimation, whereas in the case of binary variables (i.e., gender and type of sport), DCAT (Asparouhov & Muthén, 2014) was applied.

Third, TMDs and EIs were calculated. Then, univariate general linear models (GLMs) were carried out to test how background variables and their interaction terms were separately

related to TMDs and EIs. Analyses began by including all interaction terms in the analysis, after which non-significant interaction terms were removed one by one from the model so that the final analysis included only statistically significant effects.

LPAs were performed using the Mplus statistical software (Version 8.0) and the standard missing-at-random (MAR) approach, which supposes that any missing data would be missing at random (Muthén & Muthén, 1998–2010). Because the indicator variables were continuous and their distributions within estimated latent profiles unknown, the parameters of the models were estimated using full information maximum likelihood (FIML) estimation with standard errors robust to non-normality (MLR estimator; Muthén & Muthén, 1998–2010). Analyses of TMDs and EIs were carried out using SPSS 28.0. The table of means (*M*), standard deviations (*SD*), and the correlations between all variables are shown in Supplemental Material S2.

Results

First, we sought to identify what kinds of mood state profiles the student-athletes displayed. Based on the LPA results (see Table 1 for the fit indices) and theoretical interpretations, we arrived at a four-profile solution. According to the LMR, the four-profile solution was better than the three- profile solution ($p < .001$), but the five-profile solution was not statistically better than the four-profile solution ($p = .067$). Although the AIC, BIC, and aBIC suggested that a six-profile solution would be a better option than solutions with fewer profiles, in both the five- and six-profile solutions, one profile had a very small sample size ($n = 9$; ~2%), which would have made it difficult to generalize the findings. Furthermore, from the theoretical point of view, the five- and six-profile solutions did not provide any new information over the four-profile solution; that is, the new profiles produced by these solutions revealed only differences in the overall levels of mood states rather than in specific subdimensions. Specifically, the fifth profile resembled the inverse Everest profile with

somewhat lower scores on all negative mood dimensions, and the sixth profile resembled the surface profile, with average scores on all mood scores.

The four identified latent profiles are shown in Figure 1b: (1) the surface profile, (2) the Everest profile, (3) the inverse Everest profile, and (4) the iceberg profile; all were identified by Terry and Parsons-Smith (2021). In the surface profile, the scores of all mood dimensions were at the average level (between about -0.2 *SD* and +0.2 *SD*), with the vigor score somewhat lower than the other dimensions. In the Everest profile, the vigor score was above average and higher than the scores of other dimensions, which were all below average at about -1 *SD*. In the inverse Everest profile, the vigor score was below average, whereas all other dimensions were at least 1 SD above average. In this profile, the scores for tension and depression were somewhat higher than those for anger and confusion. In the iceberg profile, vigor was above average and higher than the scores of other dimensions, which were all below average (at about -0.5 or -0.6 *SD*). Compared to the Everest profile, the difference between vigor and the other dimensions was not as large in this profile as in the Everest profile. The most typical profile, which was displayed by 39.8% of athletes, was the surface profile, whereas the inverse Everest profile and the Everest profile were the least typical profiles, with only 13.2% showing each profile.

Next, the differences between the four mood state profiles in background variables—that is, sex [$\chi^2(3) = 20.17$, $p < .001$], type of sport [$\chi^2(3) = 0.80$, $p = .994$], GPA [$\chi^2(3) = 3.56$, $p = .313$], and level of performance in sport [$\chi^2(3) = 0.37$, $p = .947$]—were investigated. The sex and type of sport distributions within different profiles are shown in Table 2 and the means for the continuous variables GPA and level of sport performance in Table 3. Statistically significant group differences were found in sex. Pairwise comparisons revealed that the Everest profile differed statistically significantly from all other profiles by being more typical for males than for females.

Finally, we applied a variable-oriented approach to examine the extent to which sex, type of sport, GPA, and level of performance in sports, as well as two-way interactions of these variables, are related to student-athletes' mood states; that is, TMD and EI. The results of the GLM for TMD demonstrated, first, that none of the tested interaction terms was statistically significant. Therefore, the GLM including only the main effects of all independent variables was chosen as the final model. The results showed that sex was the only independent variable that was statistically significantly associated with the TMD [F (1, 404) = 11.60, $p < .001$]: females (M = 7.14, SD = 3.38) showed a higher TMD in the POMS (with high scores indicating more negative mood states) than males (M = 6.14, SD = 3.12). The EI results similarly demonstrated that none of the tested interaction terms was statistically significant. Therefore, the GLM including only the main effects of all independent variables was selected as the final model. The results showed that of the independent variables, GPA [F (1, 404) = 4.97, $p < .05$] and biological sex [F (1, 33) = 8.55, $p < .01$] were statistically significantly associated with the EI: the higher the GPA, the higher the EI. Moreover, males (M = 1.81, SD = 0.76) had a higher EI than females (M = 1.62, SD = 0.68).

Discussion

In the present study, we investigated the kinds of mood state profiles that Finnish high school-aged student-athletes displayed and how typical these profiles were among participants. The relations of the mood state profiles, along with those of the TMD and EI, to biological sex, type of sport, and level of performance in sport and in school were also examined. Four distinct mood state profiles were identified: (1) the surface profile, (2) the Everest profile, (3) the inverse Everest profile, and (4) the iceberg profile. The results showed further that the iceberg profile and the Everest profile were more typical of males than females. In addition, males displayed a more positive mood state than females, based on the

TMD and the EI. Furthermore, GPA and the EI were related in the sense that more fatigued student-athletes had a lower GPA.

The first aim of the present study was to investigate the kinds of mood state profiles that could be identified among Finnish student-athletes and how common each of the identified profiles was among them. In line with H1, three profiles identified in earlier literature among adult athletes (Terry & Parsons-Smith, 2019) were found among the four we identified in our sample of student-athletes. The results showed further that most of student-athletes in our sample were characterized by the surface mood state profile (39.8%), with the Everest and inverse Everest profiles tied for least typical profile (13.2%). The iceberg profile was found in 33.8% of the athletes. Among a sample of adult athletes, Terry and Parsons-Smith (2019) reported that the iceberg profile occurred in 30%, the inverse Everest profile in 5%, and the surface profile in 21% of athletes. They did not identify the Everest profile at all, whereas in our study it was found among 13.2% of the student-athletes. However, it should be noted that the student-athletes characterized by Everest profile in our study showed similar levels of vigor as student-athletes with the iceberg profile; the difference between these two groups was only in the levels of negative mood dimensions. In our study, student-athletes had similar amounts of representation in the iceberg profile as the athletes in the study by Terry and Parsons-Smith (2019). Moreover, the surface profile was much more typical in our study (39.8%) than in theirs (21%). This profile is characterized by average scores in all mood dimensions (Terry & Parsons-Smith, 2021). One explanation for this pattern in the results may be that adolescents are usually more prone to negative moods than are adults, because, at this developmental stage, they experience a variety of significant psychological, physiological, and social shifts in their lives (Paus et al., 2008).

Second, we aimed to investigate how the identified mood state profiles were related to sex, type of sport, and level of performance in sport and in school. Of these background

variables, only sex was found to be related with mood state profiles. Male athletes were much more likely to display the Everest profile (74.2%) than were female athletes (25.8%). Similar kinds of results were found when the variable-oriented approach was applied to mood states: TMD and EI scores were more positive among males than females. Overall, this pattern of findings is in line with previous research in which female athletes' mood states were found to be more negative than those of male athletes (Abbas et al., 2020; Reynoso-Sánchez et al., 2021; Terry & Parsons-Smith, 2021). As the Everest profile usually occurs in superior performers who are mentally healthy (Terry, 1995) and the TMD and EI have been related to better mood states (Selänne et al., 2013), the results of the present study raise further concern that female student-athletes may be at greater risk of mental disturbance and performance degradation than males. The more negative moods of females can be explained, in part, by physiological changes during puberty. In adolescent females, body changes often lead to dissatisfaction (Stice & Whitenton, 2002) and, as adipose tissue increases, to a temporary decline in sport performance, which may lower their mood (Armstrong, 2019). By contrast, puberty in males usually leads to a rapid improvement in physical performance (Handelsman, 2017), which may explain the greater frequency of Everest profiles.

In our study, GPA was positively related to EI but not to mood state profiles or TMD: the higher the GPA, the higher the EI level. As the EI accounts for the interaction between vigor and fatigue (Odagiri et al., 1996), it may describe fatigue better than the fatigue scale of POMS alone. The results of our study are in line with those of May and colleagues (2015), who showed that burnout and fatigue were negatively associated with the cognitive performance of high school students. It is possible that lack of energy and fatigue are reflected in school performance as lower grades, whereas higher energy levels manifest themselves in better performance at school. However, it is also possible that it is the high level of school performance that increases the EI.

Contrary to previous studies, our results did not show any differences among types of sports concerning mood state profiles, TMD, or EI. In previous studies, athletes in individual sports have been found to have a more negative mood state than athletes in team sports (Nixdorf et al., 2016; Pluhar et al., 2019; Reynoso-Sánchez et al., 2021; Schaal et al., 2011). One possible reason for our divergent finding is that individual and team sports in Finland offer an equally good and mentally safe training environment for young athletes and, therefore, type of sport does not play such a significant role in mood states in that country.

In the present study, mood states were also not related with the level of sport performance, although in previous literature, the higher-level performers in sports (Renger, 1993) reported better mood states than lower-level performers. For example, the iceberg profile has been found among superior performers (Terry, 1995). It has been suggested that the most successful athletes are generally more confident and withstand pressure better than athletes at lower levels; therefore, higher-level athletes display a better mood (Prapavessis, 2000). One explanation for the different results found in our study may be that, like virtually all adolescents, student-athletes are all somewhat insecure and may doubt their own capability, which is then reflected in their mood, independently of athletic performance.

Applied implications

Overall, according to the results of our study, female student-athletes are more prone to negative mood states than are males, and fatigue is associated with student-athletes' poorer academic performance at school. From a practical point of view, therefore, it is important to develop a dual career system that supports young student-athletes' coping and resilience, with particular attention to females. Young student-athletes can be under significant, even immense, pressure as they strive for success in both sports and school. This can clearly lead to a deterioration in mood. The role of athletes' teachers and coaches is important because they can increase or decrease athletes' stress and ability to cope. Teachers' awareness of the

workload of sports and coaches' awareness of the workload of school are important; only then will each be aware of an athlete's overall workload. Too often, these key actors do not communicate enough with one another, which can permit an athlete to become exhausted because of demanding workloads and constant pressure. There is thus a need for greater awareness in the world of sports about the education of athletes and its balance with sports and with the broader school culture to help students combine studies and sports as effectively as possible. The results of the POMS scale are in line with previous studies, so this can be considered a good indicator and practical tool for examining the mood state of student-athletes.

Limitations

Our study has some limitations that should be considered. First, mood state profiles were assessed only once, in the spring of the second grade of high school. In the future, longitudinal studies are needed to assess how stable the identified mood state profiles are during a dual career and how these profiles—and any changes in them—may impact student-athletes' ongoing well-being and dual career success. Second, only four background variables were investigated. There are, however, many factors beyond sports and school that can affect mood states. Third, the participants in our study were adolescent high school student-athletes. In analyzing how education and sports are and should be combined, it is important to explore different subsamples of athletes, such as those who studying at universities or in vocational schools. Fourth, because normative POMS data for Finnish student-athletes was not available, it was not possible to compare the reported mood state profiles of student-athletes with previously identified profiles of this population. In the literature, there are also more recent and popular versions of mood state questionnaires that have been highly validated (e.g., the BRUMS), so further studies using these more recent methods may be helpful in refining and/or confirming the findings of the present study and to explore the antecedents

and consequences of mood state profiles in adolescent student-athletes. Finally, future research should explore the links between perceived stress, recovery, and mood states among samples of athletes varying by culture, ethnicity, nationality, education level, and competition level. In particular, the findings of the present study underline the need for person-oriented research on mood state profiles to determine whether the profiles presented here manifest themselves in the same way in different populations and cultural contexts and whether the associates of the profiles vary across cultures and populations.

In sum, our findings represent a substantial but nevertheless initial and thus partial attempt to gain a better understanding of the mood state profiles of high school-aged student-athletes. Our data identified four mood state profiles among student-athletes: the surface profile, the Everest profile, the inverse Everest profile, and the iceberg profile. A large plurality of student-athletes fit the surface profile (39.8%). Males had overall better moods than females, as assessed by mood state profiles, TMD, and EI. The Everest profile, which is usually found in superior performers and those with good health, was significantly more typical among males (74.2%) than females (25.8%). Furthermore, fatigue, as assessed by the EI, was associated with athletes' lower academic performance. The results of our study suggest that there is a need to pay more attention to the mental well-being and resilience of young student-athletes, especially females.

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Table 1. Comparison of the latent profile analysis solutions with one to seven classes (selected solution in bold).

N	Entropy	Log L	nfp	AIC	BIC	aBIC	LMR (*p*)
1		-3780.05	12	7584.11	7633.25	7595.17	NA
2	0.86	-3163.12	25	6376.24	6478.64	6399.30	.199
3	0.90	-2909.94	38	5895.88	6051.52	5930.93	< .001
4	**0.88**	**-2809.15**	**51**	**5720.30**	**5929.19**	**5767.34**	**< .001**
5	0.89	-2750.62	64	5629.24	5891.37	5688.27	.067
6	0.87	-2709.23	77	5572.45	5887.83	5643.47	.009
7	0.85	-2673.28	90	5526.56	5895.19	5609.57	.356

Note. *N* = Number of different profiles in the solution; Log L = log-likelihood value; nfp = number of free parameters; AIC = Akaike's information criterion; aBIC = adjusted Bayesian information criterion; LMR (*p*) = *p*-value of Lo-Mendell-Rubin adjusted likelihood ratio test.

Table 2. Sex and type of sport distributions for the four mood state profiles identified among adolescent student-athletes ($N = 444$).

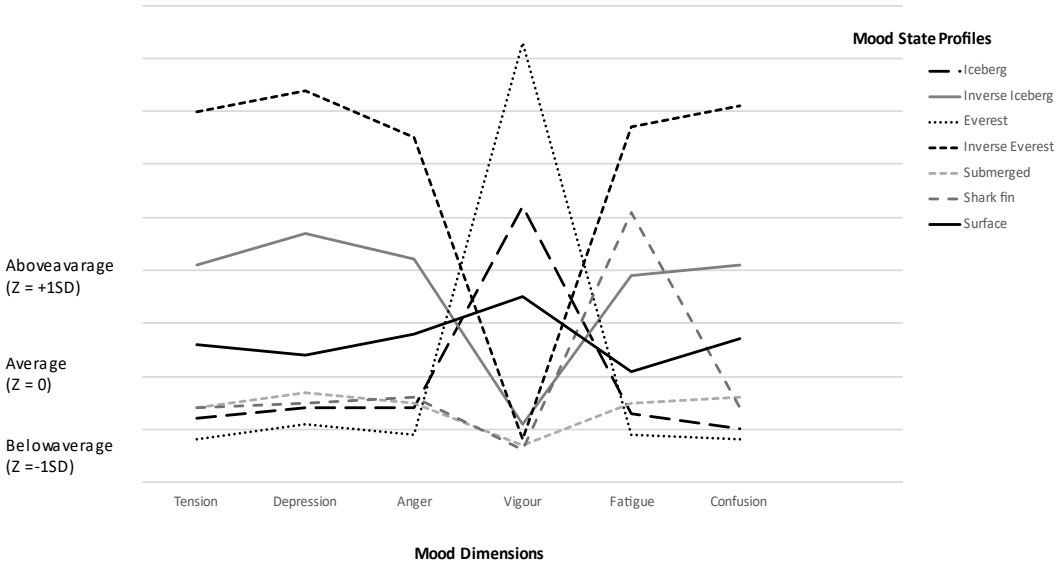
Mood state profile	Biological sex		Type of sport		Proportion of total sample (%)
	Female (%)	Male (%)	Individual (%)	Team (%)	
Surface profile	53.5	46.5	48.0	52.0	39.8
Iceberg profile	49.6	50.4	46.3	53.7	33.8
Everest profile	25.8	74.2	47.4	52.6	13.2
Inverse Everest profile	63.6	36.4	48.3	51.7	13.2

Table 3. Means (*M*) and standard errors (*SE*) of grade point average (GPA) and level of sport performance in student-athlete profile subgroups.

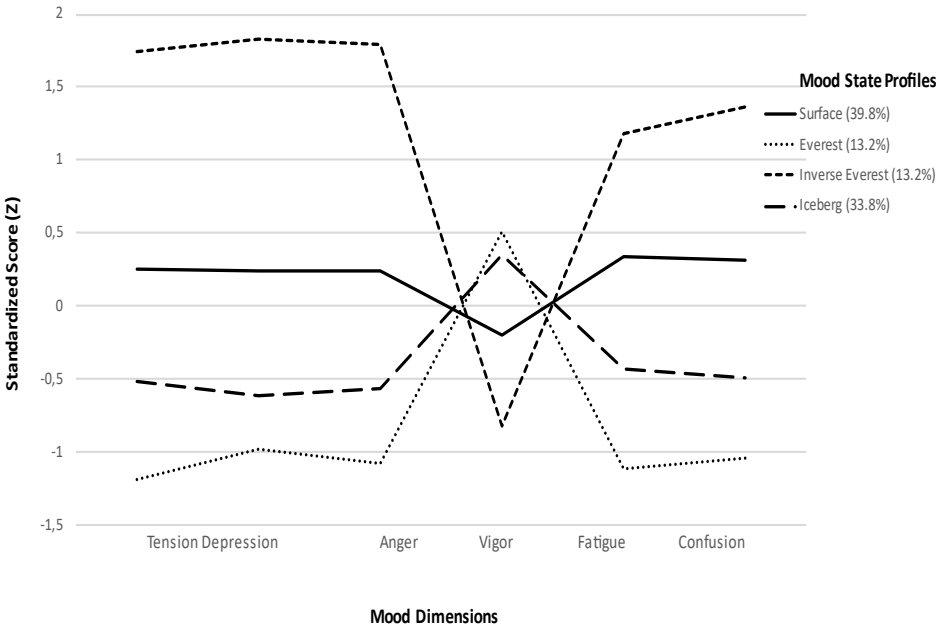
	Surface profile (*n* = 175)	Everest profile (*n* = 62)	Inverse Everest profile (*n* = 57)	Iceberg profile (*n* = 150)
	M (S.E.)	*M (S.E.)*	*M (S.E.)*	*M (S.E.)*
GPA	7.91 (0.07)	8.03 (0.15)	8.03 (0.14)	8.11 (0.08)
Level in sport	5.44 (0.28)	5.28 (0.46)	5.39 (0.44)	5.62 (0.35)

Note. The mean differences between the four profiles were not statistically significant when using significance level $p < .05$ in pairwise comparisons.

Figure 1. Applied examples of the mood state profiles identified in previous research (e.g., Terry, 1995; Terry & Parsons-Smith, 2021) (top) and mood state profiles identified in the present study among sample of student-athletes (N = 444) when using latent profile analyses (bottom).



(a) Examples of mood state profiles identified in the previous literature.



(b) Mood state profiles identified in the present study (n = 444 student-athletes).