



# Overcoming adversity during the COVID-19 pandemic: Longitudinal stability of psychosocial resource profiles of elite athletes and their association with perceived stress

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## ABSTRACT

Previous research has demonstrated that psychosocial resources are associated with elite athletes' perceived stress. However, these resources have mainly been studied separately. Using a person-oriented approach, this study aimed to identify meaningful profiles of athletes' psychosocial resources, their stability over time, and their relationship with perceived stress during the COVID-19 pandemic. To identify such patterns, separate latent profile analyses (LPA) at two measurement points T1 (June 2020) and T2 (March 2021) and a subsequent latent transition analysis (LTA) were conducted with athletic identity, resilience, perceived social support, and self-esteem for a sample of 373 Swiss elite athletes. Perceived stress was analyzed at and between T1 and T2 with a mixed-design ANOVA. For LPA, theoretical considerations and statistical criteria led to a solution of four profiles: (1) *Athletic Identifiers With Above-Average Resources* ( $n_{T1} = 235$ ;  $n_{T2} = 240$ ), (2) *Below-Average Athletic Identifiers With Below-Average Resources* ( $n_{T1} = 84$ ;  $n_{T2} = 90$ ), (3) *Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources* ( $n_{T1} = 14$ ;  $n_{T2} = 7$ ), and (4) *Athletic Identifiers With Below-Average Internal and Above-Average External Resources* ( $n_{T1} = 40$ ;  $n_{T2} = 36$ ). For LTA, both structural and individual stability was demonstrated. A large and significant main effect of perceived stress was observed for resource profiles, while there was no significant main effect for measurement point nor interaction effect. Direct comparisons revealed that *Athletic Identifiers With Above-Average Resources* perceived significantly less stress than the other profiles at both time points. In conclusion, regardless of psychosocial resource profile, the perceived stress of elite athletes was stable during the COVID-19 pandemic, but exhibiting a pattern with high psychosocial resources seems to buffer against stress compared to a lack of specific resources. Therefore, sport federations and practitioners should provide tailored support programs to help athletes build all these resources.

Perceived stress among elite athletes has received considerable interest recently (Johnston, Roskowski, He, Kong, & Chen, 2021; Lin, Lu, Chen, & Hsu, 2022; Wahl, Gnacinski, Nai, & Meyer, 2020), not least because participation in high-performance sport and its prevailing demands have frequently been linked to detrimental consequences on athletes' well-being (Arnold & Fletcher, 2021; Madigan, Rumbold, Gerber, & Nicholls, 2020). Coping successfully with these demands and paving the way to athletic excellence is not only an important task for the individual athlete but also for the surrounding support system (e.g., federations, coaches, peers, and family). Based on typical yet individual trajectories within high-performance sport careers (Wylleman, Reints, & De Knop, 2013), several factors potentially impacting stress perception have been identified. Prevalent stressors include leadership and

personnel issues (e.g., relationships and expectations), cultural and team issues (e.g., group dynamics), logistical and environmental issues (e.g., facilities, travel, training, and competition conditions), performance and personal issues including career transitions (e.g., from junior to elite level and out of high-performance sport), and injuries (Arnold & Fletcher, 2012). Thus, athletes must be well-equipped to deal with these challenges to launch and maintain a successful high-performance sport career.

## 1. COVID-19: an unprecedented stressor

In late 2019, the Coronavirus disease 2019 (COVID-19) rapidly spread and shortly after, the World Health Organization declared it a

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global pandemic and public health emergency of international concern (World Health Organization, 2020). To control infection rates, national and local governing bodies enforced health policies and sanitary measures. General restrictions (e.g., social distancing, lockdown, and travel bans) as well as sport-specific consequences (e.g., limited access to training facilities and cancellation or postponement of major competitions) posed a novel situation for elite athletes. On the one hand, the infection with COVID-19 might be a stressor in itself. Prevalence data demonstrated that Swiss elite athletes tested positive more often than the general population (Schmid, Örencik, Gojanovic, Schmid, & Conzelmann, 2022). Most of these athletes, however, reported merely mild to moderate symptoms and adverse effects on athletic performance. On the other hand, the indirect effects of the pandemic can be a stressor. In particular, potential implications of restrictions like experiencing uncertainty, isolation and as a result elevated stress levels were discussed in the initial stage of the COVID-19 related literature (Schinke et al., 2020; Taku & Arai, 2020). In support of these claims, subsequent empirical studies found raised dysfunctional psychobiosocial states and stress levels compared to pre-pandemic data (Di Fronso et al., 2022). A recent systematic review by Jia et al. (2023) underlined the increase in athletes' stress perception during the pandemic dependent on individual differences (e.g., gender, type of sport, performance level, and training substitution) or COVID-19 exposure (Petrie, Messman, Slavish, Moore, & Petrie, 2023). However, there is a lack of longitudinal studies investigating the development of perceived stress during the fluctuant course of the pandemic (in terms of restrictions) as well as adaptations to novel circumstances.

## 2. Protective factors: psychosocial resources

Psychosocial resources seem to be a crucial factor in the successful coping process with stressful situations. There are two types of resources that individuals may possess and draw upon (Rowe, 1996). On the one hand, internal resources are primarily associated with an individual's personal qualities. These resources are inherent to the individual and reside within their psychological constellation such as personality traits (e.g., resilience, self-esteem, and optimism). External resources, on the other hand, refer to supportive factors that exist in an individual's environment and provide individuals with external assistance such as the various forms of social support (i.e., emotional, esteem, informational, and tangible; Rees & Hardy, 2000). In his review of social and psychological resource models, Hobfoll (2002) identified common elements underlying the protective effects of psychosocial resources. Firstly, accumulating resources reduces the risk of encountering stressors in the first place. Secondly, when facing stressful events, having various resources at one's disposal increases the likelihood of meeting the situational demands. This buffering mechanism of psychosocial resources against perceived stress is integrated in one of the most prominent stress theories: the transactional stress model (Lazarus & Folkman, 1984). It posits that, when individuals experience a state in which their resources are overwhelmed or insufficient, stress is generated, and appraisal processes and coping mechanisms are initiated. While the primary focus of Lazarus and Folkman's model is on appraisal and coping, they acknowledged that individuals' internal and external resources play a crucial role in shaping these processes. In particular, the model states that, after a primary evaluation of the threat of a stressor, the resources available to an individual decide what coping strategies to employ to effectively address the challenge.

In light of these theoretical considerations, it becomes evident that even though elite athletes share many stressors across their athletic career, appraising and facing them is highly specific to the individual. A plethora of sport-environmental as well as individual differences have been identified as either protective or risk factors for elite athletes' stress perception (Kuettel & Larsen, 2020). In particular, domain-general internal resources such as personality traits (e.g., self-esteem; Lundqvist & Raglin, 2015, resilience; Sarkar & Fletcher, 2014) as well as

domain-general external resource factors like social relations (e.g., positive social relationships or social support; Freeman, 2021) were found to be linked to stress perception. As Watson's (2016) study shows, this is also true for the domain-specific construct of athletic identity which has received substantial attention in the field of athletic career research. Despite not perfectly aligning with the conventional conceptualization of psychosocial resources, athletic identity can and will be included here because it is described as a cognitive structure that guides and organizes processing of self-related information (Brewer, van Raalte, & Linder, 1993).

While the nature of the association with perceived stress is evident for most of the aforementioned factors, it is not in the case of the relationship between athletic identity: On the one hand, higher levels of athletic identity can protect against burnout (Edison, Christino, & Rizzone, 2021). On the other hand, adverse outcomes can be observed when the sporting environment is disrupted. In particular, increased levels of perceived stress have been found among injured athletes with a strong athletic identity (Renton, Petersen, & Kennedy, 2021). When transitioning out of high-performance sport, athletic identity and potential identity foreclosure have been linked to adjustment difficulties (Park, Lavalée, & Tod, 2013). Thus, a strong athletic identity does not always have protective effects.

In addition to the findings on protective and risk factors for perceived stress in the regular sporting context, studies conducted early in the COVID-19 pandemic seem to corroborate these relationships: Associations between elite athletes' stress perception and social support (Hagiwara, Tsunokawa, Iwatsuki, Shimozone, & Kawazura, 2021; Yamaguchi et al., 2021), self-esteem (Poucher, Tamminen, Sabiston, & Cairney, 2022), and resilience (Gupta & McCarthy, 2021) were demonstrated during the COVID-19 pandemic. Moreover, maintaining athletic identity during the sporting break was linked to more positive outcomes than giving up one's athletic identity (Graupensperger, Benson, Kilmer, & Evans, 2020). Thus, the aforementioned domain-general resources and domain-specific factor seem not only crucial for the relationship between general stressors and stress perception, but also for the relationship between specific, that is pandemic-related, stressors and perceived stress.

## 3. The present research

The protective effects of individual psychosocial resources have been identified both in the context of general stressors as well as in dealing with challenges specific to the COVID-19 pandemic. The complexity of the diverse relationships between these resources and the outcome variable of perceived stress requires adopting a dynamic-interactionist perspective. It proposes that human development and functioning is a continuous process with reciprocal interactions and potential compensation of relevant factors (Gariépy, 1996). The person-oriented approach (Bergman, Magnusson, & El-Khoury, 2003), which provides methods for identifying homogenous subgroups from a heterogenous population, integrates these postulates. However, rather than establishing linear relationships between independent and dependent variables that fail to account for complex human development from a dynamic-interactionist perspective (Lerner, 2006; Magnusson & Stattin, 2006; Overton, 2015), the person-oriented approach allows to identify distinct profiles with similar constellations on key indicators (e.g., psychosocial resources). Here, the psychosocial constellation of a person is not composed of aggregated scores of isolated factors (variable-oriented approach; Bergman & Trost, 2006). Additionally, the stability of profiles across time can be examined through developmental trajectories on an individual level (individual stability) and the similarity of profiles on a group level at different measurement points (structural stability; Bergman et al., 2003).

Consequently, the first aim of the study was to find meaningful profiles based on psychosocial resource indicators (athletic identity, resilience, perceived social support, and self-esteem) of elite athletes and

to test on an exploratory basis individual and structural stability as psychosocial resource profiles might alter due to influences of the COVID-19 pandemic. In order to further characterize the identified profiles, they were described in terms of age, gender, and type of sport (i. e., Olympic winter sport, Olympic summer sport, non-Olympic sport). In line with the explorative nature of the person-oriented approach, no hypotheses about the composition of the profiles were formulated.

The second aim was to examine the relationship between the identified profiles and perceived stress. Specifically, the study sought to explore differences in perceived stress of psychosocial resource profiles (between-group), the development of perceived stress during the COVID-19 pandemic (within-group), as well as the relationship of that development with resource profiles (interaction effect). After determining the psychosocial resource profiles, it becomes possible to formulate theory-driven hypotheses pertaining to the between-group differences of stress perception exhibited by these profiles. However, it could be expected a priori already that perceived stress during the early stages of the pandemic with its severe restrictions into the daily and sporting lives of elite athletes to be higher than in the later stages when things returned to normality (hypothesis 1, H1).

## 4. Methods

### 4.1. Participants

In total, 1387 Swiss elite athletes met the inclusion criteria for both measurement points and were invited to the survey. First, they had to be national squad members from Olympic sports, floorball, or orienteering. The latter two sports were included because the Swiss Olympic Association ranks them in the top two categories based on their level of international competitiveness and popularity in Switzerland (Swiss Olympic Association, 2022). Second, athletes competing exclusively in junior competitions and participants with incomplete data (more than 50% of the total data of each measurement point) were omitted, resulting in a sample of 384 athletes, among them multiple Olympic and world championship medalists, from 62 sports. Based on demographic and sport-related characteristics, a direct binary logistic regression was conducted to investigate response behavior. In particular, study participation was regressed on age, gender, type of sport (i.e., Olympic summer sports, Olympic winter sports, and non-Olympic sports), and performance level. The overall model was statistically significant,  $\chi^2(7) = 187.50$ ,  $p < .001$ , Nagelkerke  $R^2 = 0.18$ ,  $n = 1387$ , indicating a systematic difference between respondents and nonrespondents. Inspection of individual predictors revealed that gender was not significantly associated with participation. However, young athletes, Olympic winter sports as well as respondents with high performance levels were slightly overrepresented. The increased participation rate of winter sport athletes might be due to both surveys being conducted in their off-season. Additionally, the overrepresentation of athletes with an elevated performance level might be attributed to the fact that this study was supported by the Swiss Olympic Association and the Swiss Sport Aid Foundation. As a result, successful athletes who benefit most from these institutions might have felt particularly motivated to participate.

### 4.2. Measures

Demographic and sport-specific information was collected. Additionally, five validated questionnaires were used to assess psychosocial resources and stress for both measurement points. For reasons of data analysis (see below), the overall scales were used.

- (a) *Athletic identity* was assessed using the short version of the Athletic Identity Measurement Scale (AIMS; Brewer et al., 1993), which consists of 7 items (e.g., “I consider myself an athlete”). Participants responded to these items using a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The

internal consistency of the scale was found to be acceptable, with a Cronbach’s alpha coefficient of 0.71 at T1 and 0.74 at T2. Mean scores were used in subsequent analyses with high scores indicating a strong identification with the athletic role.

- (b) *Resilience* was measured via the Brief Resilience Scale (BRS; Smith et al., 2008), a questionnaire - designed to evaluate an individual’s capacity to recover from adversity. Participants rated their agreement with six statements such as “I tend to bounce back quickly after hard times” on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The BRS demonstrated satisfactory internal consistency (T1  $\alpha = 0.78$ , T2  $\alpha = 0.80$ ) and high mean scores indicated pronounced resilience.
- (c) *Perceived social support* was evaluated using the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988), which is a 12-item questionnaire designed to determine respondents’ perceptions regarding the sufficiency of support they receive. It is scored on a 7-point Likert scale ranging from 1 = *strongly disagree* to 7 *strongly agree* and internal consistency of the scale was found to be excellent (T1  $\alpha = 0.92$ , T2  $\alpha = 0.91$ ). High mean scores reflected a high degree of perceived social support.
- (d) *Self-esteem* was assessed via the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), which measures an individual’s overall sense of self-worth based on perceptions about oneself (e.g., “I feel that I have a number of good qualities”). The RSES consists of 10 items, with participants responding on a 6-point Likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The internal consistency of the RSES was satisfactory with Cronbach’s alpha coefficients of 0.76 at T1 and 0.81 at T2. To obtain a total score, the mean score across all items was computed. High values were indicative of high self-esteem.
- (e) *Perceived stress* was measured using the 10-item Perceived Stress Scale (PSS; Cohen et al., 1983). Participants indicated on a 5-point Likert scale (0 = *never* to 4 = *very often*) how often they felt or thought a certain way during the past few weeks (e.g., “How often have you found that you could not cope with all the things that you had to do?”). Again, internal consistency can be rated as good (PSS T1  $\alpha = 0.81$ , T2  $\alpha = 0.81$ ). A high mean score indicated a high amount of perceived stress.

### 4.3. Procedure

This online survey (programmed on the software LimeSurvey, version 2.50) was sent out in June 2020 (T1) when severe restrictions to everyday and sporting life were in effect and uncertainty of future developments was present. Participants were invited to the second measurement nine months later, in March 2021 (T2). Both internationally and particularly in Switzerland, restrictions were either loosened or abolished partly because of vaccination availability. Response periods were one month for both measurement points and depending on their first language, German or French versions of the survey were presented. Separate analyses of the central constructs of this study revealed similar and satisfactory internal consistencies, with no evidence of violation in terms of homoscedasticity of variance as determined by Levene’s test. This study accords with the recommendations of the ethical principles of psychologists and the code of conduct and thus was approved by the ethics committee of the Faculty of Human Sciences of the University of Bern. All participants gave their written informed consent before participation.

Of the eligible sample, partially missing data were observed for seven athletes at T1 (1.8%) and three athletes at T2 (0.8%). Using the expectation maximization algorithm of IBM SPSS MVA (IBM Corp., 2021), missing data were singly imputed based on available demographic, athletic, vocational, financial, and psychological information. Additionally, a multivariate outlier analysis comparing Mahalanobis distance with the  $\chi^2$  distribution at  $\alpha = 0.001$  (Tabachnick & Fidell, 2019) led to

the non-consideration of 11 cases with anomalous patterns of indicator variables. Thus, the final sample consisted of 373 elite Swiss athletes ( $M_{\text{age}} = 25.55$  years,  $SD = 4.71$ ; 44.8% female, 55.2% male; Olympic summer sports = 59.5%, Olympic winter sports = 35.1%, non-Olympic sports = 5.4%).

#### 4.4. Data analysis

In accordance with the first aim of the study, latent profile analyses (Masyn, 2013) were conducted separately for T1 and T2 to identify psychosocial resource profiles. Considering that highly correlated indicators in LPA can result in unstable estimates, an arbitrary weighting of constructs, and challenges in interpretation when distinguishing specific profile characteristics, the decision was made to use total scales for subsequent analyses. This approach in selecting only a few indicators is recommended to ensure greater interpretability and avoid potential issues associated with indicator overlap. Both statistical indices as well as theoretical considerations (i.e., parsimony, replication, interpretability) were considered to determine the final profile solution. Statistical indicators consisted of the Bayesian information criterion (BIC), the adjusted BIC (aBIC), Akaike's information criterion (AIC), the Bootstrapped likelihood test (BLRT), and entropy. Lower values of BIC, aBIC, and AIC and higher entropy indicated better model fit. As for the BLRT, a  $p$ -value of less than 0.05 indicated a better fit for the  $k$ -pattern solution compared to  $k-1$  patterns (Morin & Wang, 2016). Standardized scales were used to ease interpretability and comparability. To test for differences in patterns on demographic and sport-related factors (e.g., age, gender, type of sport), Wald's-tests were used (Bakk & Vermunt, 2016).

Subsequently, a latent transition analysis was conducted to examine pattern stability. On an overall level, structural stability was investigated through measurement invariance of patterns across measurement points (Morin, Meyer, Creusier, & Biétry, 2016). A configural similarity model with freely estimated indicator means was compared to a structural similarity model with equal indicator means using a  $\chi^2$  difference test with restricted maximum likelihood estimation and Satorra-Bentler scaling correction (Morin, Meyer, et al., 2016; Olivera-Aguilar & Rikoon, 2018). On a specific level, an indicator of structural stability ( $SS_i$ ) was calculated by averaging the squared Euclidian distance between corresponding patterns (lower values indicating greater similarity; Bergman et al., 2003). Individual stability was evaluated by estimating transitional probabilities from T1 to T2.

To investigate the relationship between the identified profiles and perceived stress and thus to answer the second research question, a mixed-design ANOVA was performed. This approach was indicated because Wald's test was not feasible due to a singular covariance matrix caused by an inadequate sample size for the longitudinal analysis (Tanaka, 1987). The analysis focused on three key effects: the main effect for profile differences in perceived stress (between-group), the main effect of measurement point for observing changes in perceived stress over time (within-group), and the interaction effect that examines the within-group development of perceived stress across different profiles.

LPA and LTA were carried out in Mplus Version 8.7 (Muthén & Muthén, 1998–2017), while descriptive statistics, imputation, and the mixed-design ANOVA were conducted with SPSS Version 28 (IBM Corp., 2021). The significance level was set at  $\alpha = 0.05$ .

## 5. Results

### 5.1. Psychosocial resource profiles of elite athletes

Descriptive statistics for the scores of the indicators can be found in Table 1. For each measurement point, two-to six-profile solutions were evaluated. As shown in Table S1 (Supplementary Material), an improvement in BIC, aBIC, and AIC was observed with each increment in the number of profiles. Looking at the elbow criterion, improvements in statistical criteria flattened out after the four-profile solution suggesting

**Table 1**  
Descriptive statistics ( $n = 373$ ).

Scale	<i>M</i>	<i>SD</i>	Skewness	Kurtosis
T1: June 2020				
Athletic identity	5.72	0.75	-0.60	0.44
Resilience	3.74	0.60	-0.33	0.35
Perceived social support	6.34	0.74	-1.38	1.69
Self-esteem	4.99	0.63	-0.60	-0.15
Perceived stress	1.47	0.56	0.28	0.19
T2: March 2021				
Athletic identity	5.66	0.80	-0.83	1.55
Resilience	3.71	0.63	-0.44	0.36
Perceived social support	6.32	0.73	-1.22	1.29
Self-esteem	4.99	0.65	-0.65	0.01
Perceived stress	1.49	0.56	0.17	-0.16

Note. Ranges of scales: athletic identity 1 = *strongly disagree* to 7 = *strongly agree*; resilience 1 = *strongly disagree* to 5 = *strongly agree*; perceived social support 1 = *strongly disagree* to 7 = *strongly agree*; self-esteem 1 = *strongly disagree* to 6 = *strongly agree*; perceived stress 0 = *never* to 4 = *very often*.

only negligible better fit in models. BLRTs were significant for all models indicating a better fit by the addition of another profile, whereas entropy values pointed to an optimal solution between four to six profiles. Last, theoretical considerations in terms of parsimony, replicability, interpretability, and profile size led to the selection of the four-profile solution as the most appropriate for both T1 and T2 (the posterior probabilities can be found in Table S2 of the Supplementary Material).

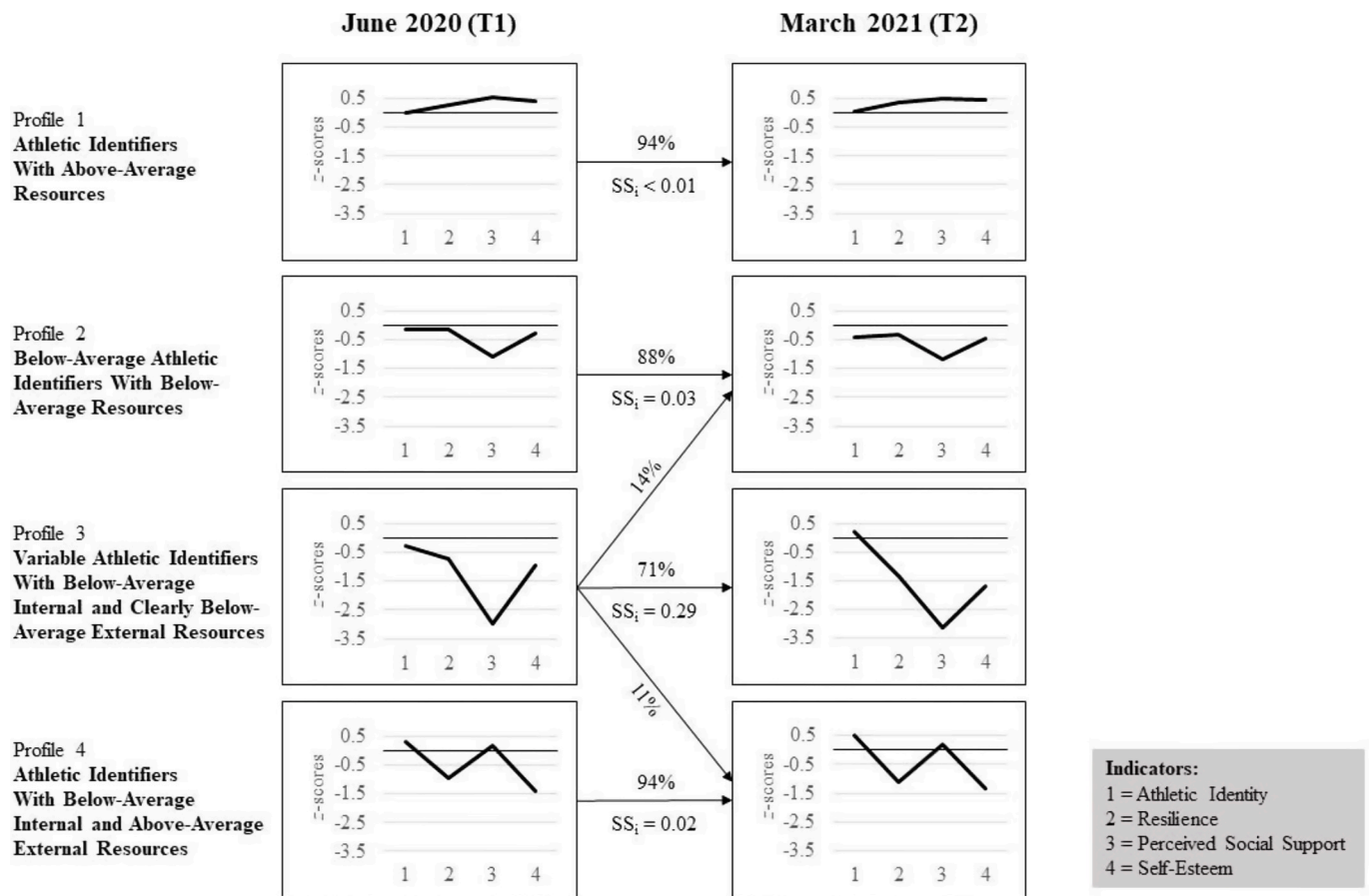
Descriptive statistics (mean raw and z-standardized scores) for the four-profile solutions are given in Table 2 and displayed in Figure 1. In addition, demographic and sport-related information for further characterization of the profiles is summarized in Table 3. Regarding the labeling of profiles, the approach proposed by Rowe (1996), which involves categorizing internal and external resources, was followed. Participants scoring above- or below-average compared to the entire elite athlete sample were classified as having "above-average" or "below-average" respective resources. The particular significance of this relative interpretation lies in the specificity of the current sample, composed of elite athletes. Notably, elite athletes typically exhibit higher absolute scores on some resources, such as athletic identity, compared to athletes with lower performance levels or the general population norms of the questionnaires. Thus, above-/below-average labels of the profiles must be interpreted in the context of the current elite athlete sample. Additionally, when participants' scores deviated more than two standard deviations from the mean, the adverb "clearly" was added.

Most athletes belong to Profile 1, which can be labeled as *Athletic Identifiers With Above-Average Resources* (T1:  $n = 235$ , 63%; T2:  $n = 240$ , 64%). This profile is characterized by a pattern of high values on all indicators. Exploratory analyses relative to the total sample based on demographic information revealed a balance in age, gender, sports category, and weekly hours invested in the three activities (i.e., sport, education, vocation) while earning the highest annual income. Moreover, the hours invested in sport almost doubled from 14.99 at T1 to 27.46 at T2. The *Below-Average Athletic Identifiers With Below-Average Resources* represent the second most numerous profile (T1:  $n = 84$ , 22%; T2:  $n = 90$ , 24%). Compared to the sample, they scored below-average on all indicators with a particularly low value on perceived social support and a slight overrepresentation of male athletes from Olympic summer sports was observed. The number of sport hours was also twofold at T2 for this profile. A comparatively small fraction of athletes (T1:  $n = 14$ , 4%; T2:  $n = 7$ , 2%) resembled the pattern of *Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources*. Similar to the *Below-Average Athletic Identifiers With Below-Average Resources*, this profile had low values on all indicators except for a relatively high level of athletic identity at T2. Especially low were the values for external resources (i.e., perceived social support approximately three standard deviations below the

**Table 2**  
Descriptive statistics of indicators and perceived stress at T1 and T2 for latent profiles.

Profile		n (%)	Athletic identity M (SD)	Resilience M (SD)	Perceived social support M (SD)	Self-esteem M (SD)	Perceived Stress M (SD)
Profile 1 <i>Athletic Identifiers With Above-Average Resources</i>	T1	235 (63%)	5.73 (0.74)	3.91 (0.54)	6.74 (0.34)	5.26 (0.49)	1.31 (0.49)
	T2	240 (64%)	5.70 (0.77)	3.92 (0.54)	6.69 (0.40)	5.29 (0.49)	1.33 (0.50)
Profile 2 <i>Below-Average Athletic Identifiers With Below-Average Resources</i>	T1	84 (22%)	5.60 (0.74)	3.65 (0.54)	5.54 (0.34)	4.83 (0.49)	1.69 (0.60)
	T2	90 (24%)	5.34 (0.77)	3.51 (0.54)	5.44 (0.40)	4.69 (0.49)	1.65 (0.52)
Profile 3 <i>Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources</i>	T1	14 (4%)	5.50 (0.74)	3.30 (0.54)	4.16 (0.34)	4.39 (0.49)	1.86 (0.60)
	T2	7 (2%)	5.84 (0.77)	2.87 (0.54)	4.02 (0.40)	3.91 (0.49)	2.00 (0.36)
Profile 4 <i>Athletic Identifiers With Below-Average Internal and Above-Average External Resources</i>	T1	40 (11%)	5.95 (0.74)	3.17 (0.54)	6.47 (0.34)	4.11 (0.49)	1.87 (0.46)
	T2	36 (9%)	6.07 (0.77)	3.01 (0.54)	6.46 (0.40)	4.11 (0.49)	2.07 (0.53)

Note. Due to convergence problems, variances were constrained to be equal across profiles for indicators. Ranges of scales: athletic identity 1 = *strongly disagree* to 7 = *strongly agree*; resilience 1 = *strongly disagree* to 5 = *strongly agree*; perceived social support 1 = *strongly disagree* to 7 = *strongly agree*; self-esteem 1 = *strongly disagree* to 6 = *strongly agree*; perceived stress 0 = *never* to 4 = *very often*.



**Figure 1.** Psychosocial Resource Profiles for Both Measurement Points  
Note. Transitional probabilities (arrows, only for probabilities  $\geq 10\%$ ) and indicators of structural stability (SS<sub>i</sub>) are displayed.

mean). This profile had the highest mean age with an overrepresentation of male and Olympic summer sport athletes. Furthermore, the invested hours into their sport career approximately tripled from 10.46 at T1 to 30.16 at T2. Last, the *Athletic Identifiers With Below-Average Internal and Above-Average External Resources* (T1: n = 40, 11%; T2: n = 36, 9%) demonstrated a pattern of high athletic identity, high perceived social

support (external resource) and low values on resilience and self-esteem (internal resources). Furthermore, this profile had the youngest mean age with an overrepresentation of female athletes, Olympic summer sports, and low annual income. The volume of sport hours increased from 14.49 at T1 to 30.70 at T2.

By combining these profiles with the findings of previous research on

**Table 3**  
Demographic information of psychosocial resource profiles.

		Gender		Age (years)	Sports category			Weekly hours			
		Male (%)	Female (%)		Olympic summer (%)	Olympic winter (%)	Non-Olympic (%)	Sport (hrs)	Education (hrs)	Vocation (hrs)	Annual income (CHF)
Profile 1 <i>Athletic Identifiers With Above-Average Resources</i>	T1	56.2	43.6	24.79	55.3	41.3	5.4	14.99	7.19	6.23	45,591
	T2	56.9	43.1	25.22	55.6	38.6	5.9	27.46	7,31	6.24	45,058
Profile 2 <i>Below-Average Athletic Identifiers With Below-Average Resources</i>	T1	62.1	37.9	25.06	62.7	29.8	7.5	13.60	7.47	6.59	39,205
	T2	65.8	34.2	26.39	61.7	33.6	4.7	27.04	8.15	7.86	35,795
Profile 3 <i>Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources</i>	T1	72.6	27.4	26.86	79.4	20.6	0.0	10.46	4.40	10.42	32,040
	T2	79.5	20.5	29.61	73.8	17.4	0.0	30.16	9.95	9.51	34,806
Profile 4 <i>Athletic Identifiers With Below-Average Internal and Above-Average External Resource</i>	T1	33.1	66.9	23.63	76.3	20.5	3.2	14.49	9.29	3.93	27,279
	T2	29.0	71.0	24.94	77.8	17.4	4.8	30.70	7.37	1.33	34,156

Note. Due to information sensitivity, annual income was measured on an 8-point Likert scale ranging from 1 ≤ 14,000 CHF over 4 = 50,001–70,000 CHF to 8 ≥ 200,000 CHF; for reference 1 CHF = 1.08 USD in March 2021). For mean calculation, mid values of these ranges were used as an estimation of annual income (i.e., 1 = 7000 CHF over 4 = 60,000 CHF to 8 = 250,000 CHF).

the relationship between psychosocial resources and perceived stress, the following hypotheses for the second research question can be made: H2) *Athletic Identifiers With Above-Average Resources* perceive significantly less stress than all other profiles. H3) *Athletic Identifiers With Below-Average Internal and Above-Average External Resources* perceive significantly less stress than *Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources* and *Below-Average Athletic Identifiers With Below-Average Resources*.

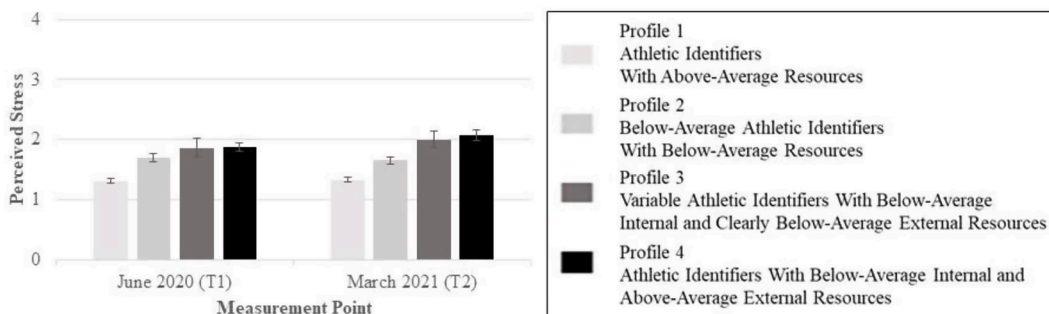
5.2. Structural and individual stability of psychosocial resource profiles across measurement points

Structural measurement invariance testing by comparing configural and structural similarity models indicated no statistically significant violation of profile stability,  $\chi^2(16) = 16.08, p = .45$ . However, an inspection of the average squared Euclidian distances between the profiles across measurement points revealed that the structural stability of Profile 3 (*Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources*;  $SS_i = 0.29$ ) was slightly lower than the one of the other profiles ( $SS_i \leq 0.03$ ). Inspecting individual stability, 92.7% ( $n = 346$ ) of all elite athletes stayed in the same psychosocial resource profile across measurement points. The athletes of Profile 1 (*Athletic Identifiers With Above-Average Resources*) and Profile 4 (*Athletic Identifiers With Below-Average Internal and Above-Average External Resources*) remained in their respective profile most often (94%). Some transitions from Profile 3 (*Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources*) at

T1 to Profile 2 (*Below-Average Athletic Identifiers With Below-Average Resources*; 14%) and Profile 4 (*Athletic Identifiers With Below-Average Internal and Above-Average External Resources*; 11%) at T2 were observed. However, none of the across-profile transitions exceeded 15% indicating individual stability.

5.3. Relationship of perceived stress with psychosocial resource profiles

Figure 2 depicts perceived stress levels by resource profiles (at T1) and measurement point. The mixed-design ANOVA revealed a large and statistically significant main effect for resource profiles,  $F(3, 369) = 21.79, p < .001, \eta_p^2 = 0.150$ , no significant main effect for measurement point,  $F(1, 369) = 2.71, p = .10, \eta_p^2 = 0.007$ , and no interaction between resource profiles and measurement point,  $F(3, 369) = 2.55, p = .06, \eta_p^2 = 0.020$ . In order to better understand the main effect for resource profiles, post-hoc comparisons were calculated using Gabriel’s method. It is considered particularly suitable in situations in which population variances are homogeneous and sample sizes differ across groups (Field, 2018). The analysis disclosed that Profile 1, *Athletic Identifiers With Above-Average Resources*, reported significantly ( $ps \leq .001$ ) lower perceived stress than all other profiles comprising athletes lacking either internal or external resources or both: Profile 2 (*Below-Average Athletic Identifiers With Below-Average Resources*;  $M_{\text{Difference}} = -3.50, SE = 0.58$ ), Profile 3 (*Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources*;  $M_{\text{Difference}} = -4.00, SE = 1.26$ ), and Profile 4 (*Athletic Identifiers With Below-Average Internal and Above-Average External Resources*;  $M_{\text{Difference}} = -4.71, SE = 0.78$ ). No



**Figure 2.** Perceived Stress of Psychosocial Resource Profiles for Both Measurement Points  
Note. Error bars represent standard errors of the mean.

significant differences were observed in the other pairwise comparisons.

## 6. Discussion

The study had two aims: The first aim was to find meaningful psychosocial resource patterns of elite athletes based on key indicators (i.e., athletic identity, resilience, perceived social support, and self-esteem), to test structural and individual stability, and to describe the profiles. The second aim was to investigate the development of perceived stress during the COVID-19 pandemic and the association of perceived stress development with psychosocial resource profiles.

### 6.1. Identification of four stable psychosocial resource profiles

Both at the initial stage of the pandemic as well as a year after its initial outbreak, four distinct psychosocial resource profiles demonstrating individual and structural stability were found. Most athletes were allocated to the *Athletic Identifiers With Above-Average Resources* exhibiting high psychosocial resources in dealing with potential stressors. This profile not only receives external resources (i.e., perceived social support) through their immediate environment (e.g., significant others, family, friends, coaches, teammates), but is also endowed with internal resources (i.e., resilience and self-esteem) and exhibits a strong athletic identity. All other profiles lack at least one psychosocial resource. The *Below-Average Athletic Identifiers With Below-Average Resources* were the second most common profile. Relative to the sample, they have low values on all internal resource indicators with a particularly low value on the external resource of perceived social support. The *Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources* demonstrate even lower values on psychosocial resources. Strikingly, these athletes perceive limited access to social support and an increase in athletic identity was observed at T2, which might be explained by the return to their regular daily lives and their respective sporting hours almost tripling compared to T1.

Even though the size of this profile is small (T1:  $n = 14$ ; T2:  $n = 7$ ), this constellation of psychosocial resources is still statistically, theoretically, and practically meaningful in high-performance sport. First, these athletes were not identified as unrealistic statistical outliers. Second, prior studies with similar analytical methods (LPA) but different populations have also reported small groups of elite athletes with vulnerable profiles, highlighting the importance of not neglecting and practical occurrence of such observations (Kuettel, Pedersen, & Larsen, 2021). Third, it is worth noting that the small sample size of Profile 3 was already present in the 3-profile solution at T1, as indicated in Table S1. This 3-profile solution does not resolve the issue of small profile sizes additional to demonstrating inferior statistical indicators. These findings further emphasize the statistical and meaningful distinctiveness of this profile from the total sample of elite athletes and the rationale of choosing the 4-profile solution because opting for a 2-profile solution would result in information loss and compromise statistical properties. However, it is important to exercise caution in transferring the findings of subsequent analyses to specific individuals due to the limited profile size.

All aforementioned profiles illustrate level patterns meaning that z-standardized values are either above, below- or at average for each indicator (except for the altering values of athletic identity of Profile 3). In contrast, *Athletic Identifiers With Below-Average Internal and Above-Average External Resources* are characterized by alternating values (i.e., shape pattern) of indicator variables (Morin, Boudrias, Marsh, Madore, & Desrumaux, 2016). Specifically, these athletes indicate low internal resources (resilience and self-esteem), high values on external resources (perceived social support), and a strong athletic identity. The overrepresentation of female athletes in this profile suggests a gender difference regarding the distribution of internal and external resources. Relative to the sample, these athletes, mainly women, can draw on external resources but have only limited internal resources.

When interpreting the results, however, the distribution of values must be considered. Indicators, especially athletic identity and perceived social support, slightly deviate from a normal distribution and a ceiling effect was observed. The alleged insufficient perceived social support of the *Below-Average Athletic Identifiers With Below-Average Resources* and the *Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources* must be interpreted in relation to the total sample. These athletes do not perceive no social support in absolute terms as they indeed affirm several items of the MSPSS (Zimet et al., 1988) but in comparison to other profiles significantly less items. Moreover, the sample stems from a population of elite athletes. Hence, it is reasonable to assume a generally strong athletic identity as well as having sources of potential social support from their sport environment (e.g., teammates or coaches; Chen, 2013).

The finding that available resources altered only negligibly during the nine-month period supports the notion of structural and individual stability of the profiles and thus of treating psychosocial resources as trait instead of variable state profiles (Schmitt & Blum, 2020). The overall high stability observed in these profiles may be explained by the predominant usage of domain-general measures (i.e., resilience, perceived social support, and self-esteem) in the assessment. Unlike domain-specific measures such as athletic identity, which may be more susceptible to sport-related restrictions of the pandemic, the domain-general measures may be less influenced by a temporary disruption of high-performance sport. The relatively high occurrence of transitions from individuals belonging to Profile 3 to other profiles may be attributed to the limited sample size (and thus unreliable estimates). However, it is also plausible that these athletes experienced a temporary crisis in their psychosocial resources, characterized by low levels of perceived social support, and that even slight increments in social support facilitated a transition to a different profile.

### 6.2. Stable intraindividual stress perception but interindividual variability

Contrary to previous longitudinal research during the pandemic (Jia et al., 2023), the overall perceived stress of the current sample did not change across measurement points. Neither a worsening during confinement (Mehrsafar et al., 2021) nor potential adaption to circumstances over time could be observed (Batalla-Gavalda, Cecilia-Gallego, Revillas-Ortega, & Beltran-Garrido, 2021; Rubio, Sánchez-Iglesias, Bueno, & Martin, 2021) resulting in the rejection of H1. However, the measurement periods of those studies in the initial phase of the pandemic only extended over a few weeks. The current study investigated alterations in perceived stress over nine months, in which similar short-term fluctuations might have occurred. Nevertheless, the stress levels of Swiss elite athletes at the early phase of the pandemic (June 2020), when restrictions affected athletes' daily and sporting lives most, did not differ from the later phase (March 2021), when restrictions loosened, and athletes could return to their normal course of life. This return to normality was also empirically supported as the training volume more than doubled over this period.

Comparing the four psychosocial resource profiles with respect to perceived stress revealed profiles with increased vulnerability to experienced stressors. A pattern with high and thus presumably sufficient values on all psychosocial resources, as it is exhibited by Profile 1, seems to buffer against the adverse effects of the COVID-19 pandemic and its concomitants, which is in line with H2. Moreover, those athletes not only demonstrate the highest psychosocial resources but also socioeconomic resources (i.e., annual income) and thus did not have to deal with financial hardship on top of the pandemic-related difficulties. If athletes had external, but not internal resources at their disposal (Profile 4), this protective effect was not noticeable (rejection of H3). The athletes of Profile 4 reported similar amounts of stress during the pandemic as athletes with varying negative amplitudes on all resource indicators (Profile 2 and Profile 3).

As a result and in line with the person-oriented approach (Bergman

et al., 2003), linear assumptions about the relationship between psychosocial resources and perceived stress are inadequate. Specific meaningful patterns with potential interactions and compensations lead to a more realistic depiction of elite athletes' experiences. Moreover, the differential association has also been detected for athletic identity in previous research (Edison et al., 2021; Graupensperger et al., 2020; Manuel et al., 2002; Park et al., 2013). This finding also significantly contributes to the complex mechanisms of psychosocial resources in the secondary appraisal of a stressor and the resulting coping options with stress proposed by the transactional stress theory (Lazarus & Folkman, 1984). Previously the buffering effects for perceived stress were attributed to the mere accumulation of psychosocial resources. However, as demonstrated by the adoption of the person-oriented approach, specific interactions and potential compensation for the lack of resources play a crucial role in shaping stress perception.

Linking the current findings to the dual career literature of combining a high-performance sport career with an academic or vocational one showed no differences in hours invested into education nor vocation for psychosocial resource profiles. There is a balanced distribution of dual career athletes in all profiles and consequently, dual career athletes did not show any differences in perceived stress compared to single career athletes. Identified internal (e.g., mental toughness; De Brandt, Wylleman, Torregrossa, Defruyt, & van Rossem, 2017; De Brandt et al., 2018) as well as external resources (e.g., social support; Brown et al., 2015) to successfully cope with the wide-ranging demands of a dual career (e.g., time management, academic or workplace stressors; Brown et al., 2015; Harrison, Vickers, Fletcher, & Taylor, 2022; Stambulova & Wylleman, 2019) are thus not only relevant in a dual career context but also when dealing with other sources of potential stress.

### 6.3. Practical implications

Translating the research findings into practical implications, while also considering inter-individual differences, enables tailoring targeted interventions for specific subgroups of elite athletes (Gut, Schmid, & Conzelmann, 2020). By identifying the vulnerable psychosocial resource profiles of their athletes, sport federations, practitioners, and support providers can implement both preventive measures before and interventions during times of crisis, thereby enhancing the efficiency of their counseling services. To achieve this, it is crucial for them to recognize the significance of psychosocial resources in facilitating effective coping with stress. In particular, the immediate environment of elite athletes must be willing and ready to provide social support, particularly during periods of heightened stress. Moreover, sport psychological counseling should aid athletes in maintaining a balanced identity (Aston et al., 2022). Specific interventions should be directed towards enhancing resilience (Galli & Gonzalez, 2015) and self-esteem (Richard, Halliwell, & Tenenbaum, 2017). By doing so, not only the longevity and sustainability of a healthy athletic career is more likely, but also a successful transition out of elite sport.

### 6.4. Limitations

No pre-pandemic data for the indicator and outcome variables were available. Thus, it is not possible to make a statement about whether Swiss elite athletes perceived an elevated amount of stress after the onset and a year into the COVID-19 pandemic compared to times of normal sporting reality. However, other studies reported a drop in athletic identity (Graupensperger et al., 2020) as well as increased stress as a consequence of the pandemic and the associated the sporting break (Jia et al., 2023). These findings suggest that in a non-pandemic context the athletic identity might be even stronger for the current sample. Moreover, applying these longitudinal findings to the data of this study, potentially elevated stress levels triggered by the pandemic might still be present after one year and the alleged return to normality.

Due to the current study being conducted solely in the Swiss elite sport system (Kempf et al., 2021; Kuettel, Boyle, Christensen, & Schmid, 2018; Örencik, Schmid, Schmid, & Conzelmann, 2023), generalizations of the findings should be done cautiously and be based on comparable sport-environmental and cultural conditions as well as COVID-19 restrictions. Additionally, the overrepresentation of athletes with an elevated performance level might bias psychosocial resources, particularly the domain-specific measure of athletic identity, and stress perception. However, it remains unclear in which way the specific characteristics of this sample affect the results. Nevertheless, the comparatively large sample size of this longitudinal research design population attests robust results.

### 6.5. Future research

Future studies should address the limitation inherent in the relatively short investigation period of the current study and place a strong emphasis on longitudinal tracking both the stability of psychosocial resources and perceived stress. While the structural and individual stability of profiles over a nine-month period was demonstrated, classifying the profiles as trait profiles (Schmitt & Blum, 2020), there exists a need to explore potential transitions between these profiles during various stages of an athlete's career. This could include investigating the emergence of increased resilience in response to adversity or changes in perceived social support due to shifts in relationship or marital status.

Furthermore, it would be particularly insightful to longitudinally monitor the stress development of athletes beyond the pandemic. Existing research has established a negative association between stress and athletic performance (Rano, Fridén, & Eek, 2019). Therefore, it is crucial to examine whether athletes can return to their pre-pandemic stress levels and, how the pandemic has left its mark on their athletic development and performance levels.

In the pursuit of advancing the insight in this domain, it would be worthwhile for researchers to delve into the examination of psychosocial resource profiles across cultures and nations. While the identified profiles in this study capture the characteristics prevalent in the liberal Swiss national context, inclusive of its high-performance sport system and policies, it is plausible that variations in the sizes and configurations of these profiles could emerge within the diverse cultural contexts that encompass the global sporting community (Aquilina & Henry, 2010).

The current study was limited to investigate the relationship between psychosocial resource profiles and perceived stress among elite athletes in the context of the COVID-19 pandemic, a single unprecedented stressor for elite athletes. However, within the trajectory of an athlete's career, several predictable transition phases (e.g., initiation of sport, junior-to-senior transition, career discontinuation; Wylleman et al., 2013) and incidents (such as injury, deselection, or performance decline) exist that might prove stressful. Consequently, it would be valuable to explore whether psychosocial resource profiles may offer similar protective benefits against a diverse range of stressors encountered both during and after a high-performance sport career.

## 7. Conclusion

The current study identified four stable psychosocial resource profiles: (1) *Athletic Identifiers With Above-Average Resources*, (2) *Below-Average Athletic Identifiers With Below-Average Resources*, (3) *Variable Athletic Identifiers With Below-Average Internal and Clearly Below-Average External Resources*, and (4) *Athletic Identifiers With Below-Average Internal and Above-Average External Resources*. It also found no changes in perceived stress from the early phase of the COVID-19 pandemic (June 2020) to the return to normality (March 2021). Taking a differential perspective, however, *Athletic Identifiers With Above-Average Resources* exhibit a pattern of psychosocial resources that indicated significantly reduced perceived stress at both measurement points. These findings have implications for advancing future research on investigating the



relationship between psychosocial resources and other potential stressors in high-performance sport. Moreover, they can aid practitioners in delivering personalized support to elite athletes.

### CRedit authorship contribution statement

**Merlin Örencik:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **Michael J. Schmid:** Conceptualization, Investigation, Methodology, Project administration, Writing – review & editing. **Julia Schmid:** Formal analysis, Methodology, Software, Writing – review & editing. **Jürg Schmid:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Writing – review & editing. **Achim Conzelmann:** Conceptualization, Funding acquisition, Investigation, Project administration, Resources, Supervision, Writing – review & editing.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

The data that has been used is confidential.

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### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.psychsport.2024.102606>.

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