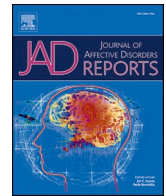




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## Research Paper

## Prevalence and predictors of anxiety, depression and stress among university students during the period of the first lockdown in Germany

Constance Karing

Friedrich-Schiller-Universität Jena, Friedrich-Schiller-Universität Jena, Jena, Germany



## ARTICLE INFO

## Keywords:

COVID-19  
 Lockdown  
 Students  
 Mental health  
 Stress  
 Mindfulness

## ABSTRACT

**Background:** The COVID-19 pandemic exacerbates the risk for mental health issues of university students. The aims of the study were to investigate the prevalence of anxiety, depression and stress among university students during the period of the first lockdown in Germany, and the associations of possible risk and protective factors with all three outcome variables.

**Methods:** A total of 2,548 university students were included in the study. The study took place during the period of the first lockdown in Germany. Multiple hierarchical regression analyses were conducted to explore the role of demographic variables, personality traits, psychological capital variables, mindfulness, COVID-19 related variables, and coping strategies on anxiety, depression and stress.

**Results:** Results showed on average mild depressive and anxiety symptoms, and moderate perceived stress among the students. Alarmingly, 35.9% of the students showed a moderate-to-severe level of depression, 27.7% reported moderate to severe symptoms of anxiety, and 25.1% perceived high stress. Mindfulness and optimism were the most relevant protective factors against depression, anxiety and stress, whereas COVID-related stressors (e.g., worries about study and financial problems, being stressed by the Corona-pandemic and media reporting, quarantine experience) as well as personal characteristics (e.g., neuroticism, older age, being female) were risk factors for increasing mental health issues and/ or stress.

**Conclusion:** The pandemic has negatively affected the mental health of students. The results emphasize the importance of both professional help for students with mental health problems and effective prevention programs on university campuses that promote coping skills, and mental health during the current pandemic.

## 1. Introduction

The COVID-19 pandemic has dramatically affected university students' lives around the world. In order to minimize the spread of the virus, most countries implemented restrictions on public and social life, including the closure of educational institutions, gastronomy businesses, hotels, retail stores, and cultural institutions, as well as restrictions on physical social contact. In Germany, the first lockdown of public and social life came in mid-March 2020. Although some of the restrictions were relaxed in May (e.g., reopening of gastronomy businesses, retail stores), the universities and other campus facilities were still closed. The closure of universities had a major impact on students' academic life (e.g., the switch to distance/online learning, closed libraries and other campus facilities), work (e.g., loss of part-time employment, financial hardship), and social life (e.g., loss of social connectedness, moving back home, no parties, no traveling; Lyons et al., 2020; Kecojevic et al., 2020).

Previous studies have already shown that university students are a

vulnerable population with regard to developing mental health issues (e.g., depression, anxiety disorders; Auerbach et al., 2018; Eissler et al., 2020). The recent pandemic exacerbates the risk for mental health issues of university students. For example, the study by Elmer et al. (2020) investigated students' mental health before and during the pandemic in Switzerland. The authors reported that students' level of stress, depressive and anxiety symptoms increased during the pandemic. X. Wang et al. (2020) assessed the severity of anxiety and depression of students in the United States. The authors found that the majority of the students reported that their anxiety and stress level got worse during the COVID-19 crisis. Moderate to extremely severe levels of depression and anxiety were reported by 48% and 38%, respectively. Similarly, a rate of 41% for anxiety was reported in a sample of 89,588 college students in China (Fu et al., 2021). Further, several studies have reported that mental health issues among university students can heightening the risk of drop-out, lower academic achievement, and lower study satisfaction (e.g., Litmanen et al., 2014; Stallman, 2010).

E-mail address: [constance.karing@uni-jena.de](mailto:constance.karing@uni-jena.de).

<https://doi.org/10.1016/j.jadr.2021.100174>

Received 8 April 2021; Received in revised form 28 May 2021; Accepted 8 June 2021

Available online 13 June 2021

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Most studies on risk factors for distress during COVID-19 pandemic have focused on general population. These studies have reported several risk factors for distress (e.g., anxiety, perceived stress; Brooks et al., 2020; Horesh et al., 2020). Horesh et al. (2020), Forte et al. (2020) and Tee et al. (2020) found that besides sociodemographic variables (e.g., age, gender) also factors related to COVID-19 circumstances (e.g., corona-related loneliness, possibility of having direct contact with infected people, concerns for family members) were associated with higher levels of anxiety, depression or perceived stress. Another study found that personality traits such as neuroticism predicted increased stress, anxiety and depression (Qian and Yahara, 2020). In a study by Liu et al. (2021), higher neuroticisms and higher extraversion were related to higher levels of perceived stress during the pandemic. A recent review by Brooks et al. (2020) showed that quarantine had a negative impact on mental health (e.g., anxiety, depression) among general population. Further, several studies have reported that higher restrictions due to lockdown and greater reductions in the numbers of contacts were related to higher mental health issues in community samples (e.g., Benke et al., 2020; Tran et al., 2020). So far, only a small number of studies on coronavirus pandemic have investigated the risk factors for mental health issues in student samples (Cao et al., 2020; Elmer et al., 2020; Fu et al., 2021). In the studies by Cao et al. (2020) and Tang et al. (2020) sociodemographic variables (e.g., gender, age) had no significant effects on depression or anxiety, whereas Fu et al. (2021) found that age was a risk factor for anxiety symptoms. The same studies reported that some COVID-19 related stressors such as worries about families' health or having a relative infected with COVID-19 were risk factors for mental health issues of university students (Cao et al., 2020; Elmer et al., 2020; Fu et al., 2021). Other stressors that were reported to impact negatively on students' mental health were decreased social contacts due to social distancing, and increased concerns on academic progression (e.g., Son et al., 2020; Wang et al., 2020b). Further, one study found that personality traits such as neuroticism was associated with reduced well-being during pandemic, but there was no effect of extraversion (Gubler et al., 2020).

Little research has also been done on protective factors (e.g., psychological capital, coping strategies, mindfulness, self-efficacy) in student samples. So far, one study showed a positive effect of psychological capital on the health status of college students during COVID-19 pandemic (Jing et al., 2021). In regard of coping strategies, Wasil et al. (2021) found that behavioural activation as a coping strategy was negatively related to depression. Sun et al. (2021) reported that social support was a protective factor of depression and anxiety among university students in quarantine. Although Li et al. (2020) found that university students with higher levels of social support, cognitive and emotional coping showed less symptoms of anxiety, behavioral coping was a positive predictor of anxiety. Further, Elmer et al. (2020) reported that the lack of emotional support and the isolation in social networks were related to negative mental health trajectories (e.g., anxiety, depression), but these variables were not associated with changes in stress. Similar findings for the impact of social support on anxiety were reported by Fu et al. (2021). Although mindfulness as well as self-efficacy have been linked to various health outcomes (e.g., Bandura, 1997; Bodenlos et al., 2015; Brown and Ryan 2003; Grøtan et al., 2019), there is a lack of studies investigating the impact of mindfulness as well as self-efficacy on university students' mental health during COVID-19 pandemic. Only one study has shown that mindfulness was a protective factor against anxiety and depression among students in quarantine (Sun et al., 2021). Another study found that self-efficacy was negatively associated with psychological stress (Arima et al., 2020).

Although the recent pandemic exacerbates the risk for mental health issues of university students, few studies to date have examined risk and protective factors for mental health issues and stress during COVID-19 pandemic in student samples. Some of the studies showed mixed results. Given that the coronavirus disease (COVID-19) was firstly identified in China, most studies on this topic have been done in China. Thus,

the aims of the current study were to examine (1) the prevalence of anxiety, depression and stress among university students during the period of the first lockdown in Germany. Further, it was investigated (2) whether there were differences between federal states with an incidence rate higher than 200 cases/100.000 population (high incidence areas, RKI, 2021) and federal states with an incidence rate lower than 200 cases/100.000 population in regard of anxiety, depression and stress scores. It was hypothesized that compared to students from areas with an incidence rate lower than 200 cases/100.000 population, students from high incidence areas would show higher levels of depression, anxiety and stress. Moreover, we investigated (3) the association of possible risk and protective factors with anxiety, depression and stress. Based on previous findings (e.g., Elmer et al., 2020; Gubler et al., 2020; Sun et al., 2021; Wasil et al., 2021), it was expected that demographics, personality, psychological variables, COVID-19 related factors, coping would be associated with mental health issues and stress.

## 2. Method

### 2.1. Participants and procedure

In the current study, a total of 3.038 students from different universities in Germany participated from 7 April until 15 May 2020, during the period of the first lockdown in Germany. Students were recruited from e-mail campaigns (e.g., universities mailing lists), and via social media announcements. A link to the online questionnaire was sent to the students. Out of the 3.038 participants, 490 participants were excluded because they did not answer the items regarding coping strategies and the outcome variables depression, anxiety or stress. Thus, 2.548 participants were included in the study (a response rate of 84%). No differences were found between completers and non-completers on age, personality traits, optimism, and the variable stressed by coronapandemic [Wilks  $\lambda = 0.996$ ;  $F(5, 2529) = 1.92, p = .09$ ], and on marital status [ $\chi^2(1) = 0.09, p = .75$ ]. However, the chi-square test for gender and grade showed that more male students and undergraduate students did not complete the questionnaire and more female students and graduate students were completers than expected [gender:  $\chi^2(1) = 7.33, p = .007$ ; grade:  $\chi^2(1) = 114.17, p < .001$ ]. All procedures performed in our study were approved by the institutional review board at the University of Jena and in accordance with the ethical standards of the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Further, the questionnaire included an informed consent page which all participants accepted before answering the questionnaire.

### 2.2. Measures

#### 2.2.1. Mental health complaints

Depression and anxiety were assessed in the current study. Anxiety symptoms were measured with the German version of the 7-item Generalized Anxiety Disorder scale (GAD-7, Spitzer et al., 2006). Participants responded to items such as "Feeling nervous, anxious, or on edge" on a 4-point Likert scale (0 = *not at all*; 3 = *nearly every day*). The total score ranged between 0 and 21. Higher scores indicating more severe symptoms of anxiety. According to Spitzer et al. (2006), the total score can be categorized as follows: no/ minimal (0–4), mild (5–9), moderate (10–14) and serious anxiety (15–20). Depression was assessed with the German version of the Patient Health Questionnaire-8 scale (PHQ-8, Kroenke et al., 2009). This eight-item scale has responses on a 4-point Likert scale (0 = *not at all*; 3 = *nearly every day*) with the total score ranging from 0 to 24. Higher scores indicating more severe symptoms of depression. The total score can be categorized into the following groups: no/ minimal (0–4), mild (5–9), moderate (10–14), serious (15–19) and very serious depression (20–24; Kroenke & Spitzer, 2002). Examples include: "Feeling down, depressed, or hopeless", "Little interest or pleasure in doing things". Several studies have demonstrated

satisfactory psychometric properties of the German versions of both scales for the German general population and student samples (e.g., Löwe et al., 2008; Reich et al., 2018; Zhou et al., 2020). Cronbachs coefficients were for anxiety 0.88, and for depression 0.86.

### 2.2.2. Stress

The German version of the 10-item Perceived Stress Scale (PSS, Klein et al., 2016) was used to assess the perception of stress. Items were rated on a 5-point Likert scale (0 = *never*; 4 = *very often*) with higher scores indicating a higher level of stress. The total score ranged between 0 and 40. In this study, stress scores  $\geq 25$  indicate high perceived stress. Previous research (Campo-Arias et al., 2014; Pedrozo-Pupo et al., 2020) has used this cut-off point in student samples. Previous studies have reported satisfactory psychometric properties of the German PSS10 for the German general population and student samples (e.g., Klein et al., 2016; Schneider et al., 2020). Example items included, "How often have you felt nervous and stressed?", "How often have you found that you could not cope with all the things that you had to do?" ( $\alpha = 0.87$ ).

### 2.2.3. Personality traits

Neuroticism, and extraversion were assessed with three items each of the German short version of the Big Five Inventory (BFI-S; Gerlitz and Schupp, 2005). Participants rated items such as „I see myself as someone who worries a lot“ (neuroticism), and „I see myself as someone who is outgoing sociable.“ (extraversion) on a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree) with a reliability of  $\alpha = 0.75$  (neuroticism) and  $\alpha = 0.84$  (extraversion). The mean rating represents the total score with higher scores reflecting greater neuroticism and greater extraversion.

### 2.2.4. Psychological capital of self-efficacy and optimism

Two dimensions of an individual's psychological capital (self-efficacy, optimism) were assessed in the study. Self-efficacy was measured by means of the German version of the 10-item General Self-Efficacy Scale (Schwarzer and Jerusalem, 1999). Items were rated on a 4-point Likert scale (1 = *not at all true*; 4 = *exactly true*; „I can always manage to solve difficult problems if I try hard enough.“) with higher scores indicating greater self-efficacy. Cronbach's  $\alpha$  was 0.88. The German Version of the Life-Orientations-Test (LOT-R, Glaesmer et al., 2008) was used to assess dispositional optimism. The scale measures optimism with three items (e.g., „In uncertain times, I usually expect the best.“, 1 = *strongly disagree*; 5 = *strongly agree*). The mean rating represents the total score with reflecting higher levels of optimism. The internal consistency for the scale was 0.73.

### 2.2.5. Mindfulness

Dispositional mindfulness was assessed with the German version of the Mindfulness Attention and Awareness Scale (MAAS; Michalak et al., 2008). The 15-item scale measuring general attention to and awareness of the present moment. However, it is designed to assess the frequency of mindlessness (Brown and Ryan 2003). Participants rated items such as „I rush through activities without being really attentive to them“ on a 6-point Likert scale (1 = *almost never*; 6 = *almost always*). To assess mindfulness, answers were reverse-coded. Thus, the mean rating represents the total score with higher scores indicating greater mindfulness. Cronbach's  $\alpha$  was 0.87.

### 2.2.6. Covid-19 items

A number of self-developed COVID-19 items were used to assess the impact of the pandemic and the lockdown on students' life and emotions. Following questions were asked: „To what extent are you worried about... your study, ... your financial situation, ... your health, ... the health of your relatives, ... overburdened hospitals because of the corona-pandemic, and ... your liberty rights?“ (5-point Likert scale: 1 = *not worried*; 5 = *very worried*), „How stressed you feel by the Corona-pandemic?“ (0% = being not at all stressed, 100% = being very

stressed), „Have you been infected by COVID-19?“ (0 = *no*/ 1 = *yes*), „Have people close to you been infected by COVID-19?“ (0 = *no*; 1 = *yes*), „Have you been quarantined?“ (0 = *no*, 1 = *yes*), „Are you still under quarantine?“ (0 = *no*; 1 = *yes*), and „Do you feel stressed by the media reporting about the Corona-pandemic?“ (1 = *not at all*; 5 = *very much*), „How satisfied are you with the quality of your social contacts (including via the internet, phone)“? (1 = *very dissatisfied*; 5 = *very satisfied*).

### 2.2.7. Coping strategies

Coping strategies were assessed using the two subscales active coping (e.g., „I take direct action to get around the problem.“, 4 items), and seeking social support (e.g., „I try to get advice from someone about what to do.“, 4 items) from the COPE (Carver et al., 1989) and the subscale acceptance (e.g., „When I cannot change something, I accept the situation as it is.“, 3 items) from the Heidelberg Form for Emotion Regulation Strategies (HFERST, Izadpanah et al., 2019). Items were rated on 5-point Likert scales (active coping, social support: 1 = *very seldom*; 5 = *very often*; acceptance: 1 = *never*; 5 = *always*). Higher scores indicating a more frequent use of the respective strategies. Cronbachs coefficients were for active coping 0.84, seeking social support. 87, and acceptance 0.77.

## 2.3. Statistical analyses

First, descriptive analyses were performed to report demographic data, COVID-19 related factors and prevalence of anxiety, depression and stress. Second, multivariate analysis of variance (MANOVA) was used to analyze anxiety, depression and stress scores among federal states with an incidence rate  $> 200$  cases per 100.000 population and federal states with an incidence rate  $< 200$  cases per 100.000 population during the survey period. Third, hierarchical regression analyses were conducted to explore the role of demographic variables, personality traits, psychological capital variables, mindfulness, COVID-19 related variables, and coping strategies on anxiety, depression and stress. All analyses were performed with IBM SPSS Statistics (Version 25). A p-value of less than 0.05 (two-tailed) was considered as statistically significant.

## 3. Results

### 3.1. Sample characteristics

Of the 2548 participants, the majority were females (74.8%). The mean age of the students was 23.67 years ( $SD = 4.59$ ). Seventy-one percent of them were undergraduate students, and almost 29% were graduate students. Moreover, more than half of the students were in a relationship, and 46.5% were single. Nearly 62% of the students were interested to take part in a stress management training and/ or mindfulness-based intervention. Compared to students, who were not interested to take part in a training, interested students reported higher levels of depression, anxiety, stress, and neuroticism, were more stressed by the Corona-pandemic, reported more worries (e.g., own and relatives' health, study, overburdened hospitals, media reporting), had lower levels of mindfulness, self-efficacy, and acceptance, but were seeking more social support [Wilks  $\lambda = 0.910$ ;  $F(24, 1846) = 7.56$ ,  $p < .001$ ]. Further, the chi-square test showed that more female students and more students living in a relationship were interested in a training than expected [gender:  $\chi^2(1) = 67.70$ ,  $p < .001$ ; grade:  $\chi^2(1) = 114.17$ ,  $p < .001$ ].

### 3.2. COVID-19 related data: descriptive statistics

Twenty-three percent ( $n = 594$ ) of the students were from federal states with an incidence rate more than 200 cases per 100.000 population (Bavaria, Baden-Wuerttemberg, Saarland, Hamburg, high incidence

areas, RKI, 2021). Among all students, 30 (1.2%) were infected by the COVID-19, and 298 (11.7%) had people close to them in their immediate environment who were infected by the coronavirus. 382 students had been quarantined and 174 were currently under quarantine. The mean of the variable being stressed by the Corona-pandemic was 49.90 ( $SD = 25.99$ ). Of the 2548 participants, nearly 40% of the students reported to feel stressed (those who reported to be very stressed and stressed) by the media reporting about the Corona-pandemic. Looking at satisfaction with the quality of the social contacts, 43.2% reported to be satisfied (those who reported to be very satisfied and satisfied) with the quality of the social contacts. Further, students also reported their worries about different areas of life during the pandemic. The main worry was about the health of their relatives, followed by worries about their overburdened hospitals, their study, their financial situation, their liberty rights, and their health. The descriptive statistics for each of the investigated variables can be seen in Table 1.

### 3.3. Prevalence of anxiety, depression and stress and stratified by incidence rate

The mean PHQ-8 score was 8.12 ( $SD = 5.29$ ), indicating mild depressive symptoms. The breakdown by depressive symptom severity was as follows: 28.9% of the students reported a normal score, 35.2% showed mild depressive symptoms, 22.2% showed moderate depressive symptoms, and 13.7% reported severe to extremely severe symptoms of depression. Further, the mean GAD-7 score was 7.14 ( $SD = 4.85$ ), falling in the mild anxiety range. The breakdown by symptom severity was: 33.4% of the students had no or minimal symptoms of anxiety, 38.9% reported mild anxiety symptoms, 18.6% showed moderate symptoms, and 9.1% reported serious anxiety. However, only 6.5% of the participants with moderate-to-severe level of anxiety or depression received treatments such as psychotherapy. Finally, the mean score of PSS-10 (perceived stress) was 19.24 ( $SD = 7.10$ ). Of the 2548 participants,

**Table 1**  
Descriptive statistics of the investigated variables.

	Mean (SD)/ N (frequency)
<b>Demographics</b>	
Gender (female)	1906 (74.8%)
Age	23.67 (4.59)
Marital status (Single)	1186 (46.5%)
Grade (undergraduate)	1799 (70.6%)
<b>Personality</b>	
Neuroticism	4.55 (1.32)
Extraversion	4.53 (1.40)
<b>Psychological Variables</b>	
Optimism	3.61 (0.84)
Self-efficacy	2.81 (0.48)
Mindfulness	4.02 (0.79)
<b>COVID-19 items</b>	
Close people infected by COVID-19	298 (11.7%)
Stressed by Corona-pandemic	49.90 (25.99)
Worries about own health	2.42 (1.13)
Worries about health of relatives	3.92 (1.04)
Worries about study	2.99 (1.34)
Worries about financial situation	2.68 (1.42)
Worries about overburdened hospitals	3.17 (1.20)
Worries about own liberty rights	2.58 (1.37)
Still under quarantine	174 (6.8%)
Have been quarantined	382 (15.0%)
Feel stressed by the media reporting	2.97 (1.37)
<b>Coping</b>	
Active Coping	3.32 (0.76)
Acceptance	3.34 (0.87)
Social support	3.57 (0.91)
Satisfaction with social support	3.21 (1.07)
<b>Outcome variables</b>	
Depression	8.12 (5.29)
Anxiety	7.14 (4.85)
Stress	19.24 (7.10)

25.1% perceived high stress.

Next, a multivariate analysis of variance was conducted to compare students from federal states with an incidence rate more than 200 cases/100.000 population and with a rate less than 200 cases/100.000 population on depression, anxiety and stress. Results from the multivariate analysis of variance showed no significant effect of group, Wilks  $\lambda = 0.99$ ,  $F(3, 2329) = 1.14$ ,  $p = .166$ . Thus, there was no significant difference between students from federal states with an incidence rate more than 200 cases/100.000 population and less than 200 cases/100.000 population in terms of depression, anxiety or stress (see Table 2).

### 3.4. Regressions on depression, anxiety and stress

Separate hierarchical regressions were conducted to predict depression, anxiety and stress, with sociodemographic variables (gender, age, marital status, grade) entered at Step 1, personality traits entered at Step 2, psychological variables (self-efficacy, optimism, mindfulness) entered at Step 3, Covid-19 items entered at Step 4, and coping strategies entered at Step 5. All parametric assumptions for multiple regression were met and no multicollinearity was detected (in all analysis the Variance Inflation Factor was less than 2.30; Hair et al., 2010). Table 3 represents the final regression model for depression, anxiety and stress. Hierarchical regression analyses showed that neuroticism, optimism, mindfulness, and COVID-19 related stressors (being stressed by the Corona-pandemic, worries about study and the financial situation,) all significantly predicted depression, anxiety, and stress. The higher the neuroticism the higher depression, anxiety and stress in students. In contrast, higher levels of optimism and mindfulness were related to lower levels of depression, anxiety and stress. Feeling stressed by the Corona-pandemic and being worried about the study and the financial situation were positively associated with depression, anxiety and general stress. In addition, feeling stressed by the media reporting about the Corona-pandemic was positively associated with higher levels of depression and stress. Being worried about the own health was positively related to higher levels of anxiety. Students who worried more about their liberty rights were more likely to become more stressed. Further, being still under quarantine was associated with greater stress symptoms, whereas having been quarantined was related to higher levels of depression and anxiety.

Although all demographic variables were significant predictors for depression and anxiety at Step 1, only age remained a significant predictor in the final model for depression. Neither gender nor marital status remained significant predictors for anxiety and depression when COVID-19 related stressors (at Step 3) or psychological variables (at Step 4) were entered into the regressions. After the entry of personality in all three regression models, grade did not remain a significant predictor for depression, anxiety, and stress. Marital status did not significantly predict stress after entering. Altogether, the results showed that older age was associated with higher levels of depressive symptoms, but with lower levels of stress. Male students demonstrating lower levels of stress. Further, self-efficacy significantly predicted depression, and anxiety at Step 3. However, after COVID-19 related stressors or coping strategies were entered into the regression models of anxiety or depression, self-efficacy did not remain a significant predictor. Thus, higher levels of

**Table 2**  
Mean and SD of depression, anxiety and stress in federal states with incidence rates more or less than 200 cases per 100,000 population.

	Incidence rate		F	p
	< 200 cases/100.000 population	> 200 cases/100.000 population		
	M (SD)	M (SD)		
Depression	8.14 (5.34)	8.06 (5.13)	0.11	.745
Anxiety	7.21 (4.86)	6.90 (4.81)	1.89	.169
Stress	19.32 (7.08)	19.00 (7.20)	1.38	.240

**Table 3**  
Results of hierarchical multiple regression analyses of depression, anxiety, and stress.

	Depression		Anxiety		Stress	
	$\beta$	<i>p</i>	$\beta$	<i>p</i>	$\beta$	<i>p</i>
<b>Demographics</b>						
Gender	−0.015	.449	−0.021	.239	−0.041	.014
Age	0.046	.021	0.034	.065	−0.037	.030
Marital status	−0.031	.089	−0.017	.340	0.006	.722
Grade	0.002	.122	−0.007	.692	0.005	.749
<b>Personality</b>						
Neuroticism	0.095	<0.001	0.207	<0.001	0.098	<0.001
Extraversion	0.016	.432	0.030	.113	0.022	.207
<b>Psychological Variables</b>						
Optimism	−0.133	<0.001	−0.122	<0.001	−0.145	<0.001
Self-efficacy	−0.046	.084	0.007	.779	−0.089	<0.001
Mindfulness	−0.286	<0.001	−0.218	<0.001	−0.190	<0.001
<b>COVID-19 items</b>						
Close people infected by COVID-19	0.032	.078	0.032	.059	0.007	.666
Stressed by Corona-pandemic	0.161	<0.001	0.232	<0.001	0.271	<0.001
Worries about own health	−0.025	.228	0.035	.068	−0.029	.104
Worries about health of relatives	0.024	.244	0.010	.617	−0.014	.417
Worries about study	0.098	<0.001	0.083	<0.001	0.172	<0.001
Worries about financial situation	0.065	.001	0.047	.011	0.066	<0.001
Worries about own liberty rights	0.028	.149	0.030	.096	0.046	.005
Worries about overburdened hospitals	0.031	.126	0.010	.600	0.015	.388
Still under quarantine	0.031	.126	0.027	.165	0.055	.002
Have been quarantined	0.065	.002	0.08	.013	0.013	.475
Feel stressed by the media reporting	0.035	.071	0.067	<0.001	0.062	<0.001
<b>Coping</b>						
Active Coping	−0.081	<0.001	−0.025	.207	−0.068	<0.001
Acceptance	−0.021	.300	−0.130	<0.001	−0.086	<0.001
Social support	−0.072	<0.001	−0.036	.055	0.025	.151
Satisfaction with social support	−0.076	<0.001	−0.023	.191	−0.055	<0.001

Note. The COVID-19 variable „own infection by COVID-19“ was not included in the analyses due to small sample size (only 30 students/ 1.2%).

**Table 4**  
Summary of the hierarchical regressions for each block of predictors on depression, anxiety, and stress.

Predictors	Depression			Anxiety			Stress		
	$R^2_{adj}$	$R^2$ Change	F Change	$R^2_{adj}$	$R^2$ Change	F Change	$R^2_{adj}$	$R^2$ Change	F Change
Step 1: demographics	.019	.019	9.55***	.029	.029	14.58***	.034	0.34	17.06***
Step 2: personality	.163	.145	156.20***	.251	.222	267.73***	.226	.192	224.65***
Step 3: psychological variables	.340	.178	162.57***	.373	.123	117.84***	.387	.161	158.47***
Step 4: COVID-19 items	.423	.086	24.40***	.493	.123	39.80***	.567	.182	68.90***
Step 5: coping strategies	.439	.017	13.43***	.508	.015	14.11***	.579	.013	13.70***

Note. \*\*\*  $p < .001$ ,  $R^2_{adj}$  = adjusted  $R^2$ .

self-efficacy were only significantly related to lower levels of stress in the final model. The results on coping strategies indicated that, higher levels of active coping, social support and satisfaction with social support were significantly associated with lower levels of depression. In contrast, only higher levels of acceptance were significantly related to lower levels of anxiety. Further, higher levels of active coping, acceptance and satisfaction with social support were significantly associated with lower levels of stress.

#### 4. Discussion

The current study investigated the prevalence of depression, anxiety and stress among university students during the first lockdown in Germany, and examined related risk and protective factors with mental health issues and stress. Results of the study showed on average mild depressive and anxiety symptoms, and moderate perceived stress among the participants. However, 35.9% of the students reported moderate to severe depressive symptoms, 27.7% showed a moderate-to-severe level of anxiety, and 25.1% of the students perceived high stress. A similar finding for perceived stress among students were reported by [Son et al. \(2020\)](#). The rates of depression and anxiety in this study were lower than those found in recent COVID-19 studies among students (e.g., [Fu et al.,](#)

[2021](#); [X. Wang et al., 2020](#)). For example, [X. Wang et al. \(2020\)](#) found that 48% of the US college students showed moderate-to-severe depression, and 38% showed moderate-to-severe anxiety. One study from China reported that 41% of the students had anxiety ([Fu et al., 2021](#)). Nonetheless, there is a higher prevalence of depression and anxiety among students during the COVID-19 pandemic when compared to the prevalence rates before the COVID-19-crisis (e.g., [Choi et al., 2020](#); [Eissler et al., 2020](#); [Rief et al., 2004](#); [Zhou et al., 2020](#)). For example, one pre-COVID-19 study analysed data from 2013 to 2017 for more than 25.000 college students and found that 6.2% of the students had moderate to extremely severe levels of depression or anxiety ([Choi et al., 2020](#)). Further, in a study with data from 2016/2017 the mean depression score (PHQ) was 6.77 ( $SD = 4.84$ ), and the mean anxiety score (GAD) was 6.23 ( $SD = 4.27$ ) in a German student sample with similar age and gender distribution to the present study ([Zhou et al., 2020](#)). Another pre-COVID-19 study on perceived stress showed that the mean PSS-10-score was 13.72 ( $SD = 6.52$ ) for students in a German sample ([Klein et al., 2016](#)).

Although about one third of the participants showed moderate-to-severe level of anxiety or depression, only 6.5% of the students received professional help for mental health problems. Similar findings were reported by [Son et al. \(2020\)](#). The authors found that 44% of the

students reported an increased level of depressive symptoms, and 8% had suicidal thoughts related to the COVID-19 pandemic, but only one person received professional help. However, the reluctance of students to seek professional help for mental health problems has been observed even before the pandemic. Several pre-pandemic studies (Eisenberg et al., 2007, 2011; Rickwood et al., 2007) have shown that young people (e.g., students) have the greatest need for mental health treatments, but they are the least likely to seek professional mental health care. A wide range of studies have identified several individual and structural barriers to seeking help, such as stigma and embarrassment about seeking help, poor mental health literacy, preference for self-reliance, concerns about confidentiality and treatment effectiveness, and community or university support system, health system structures, referral pathways, and payment systems (e.g., Clement et al., 2015; Gulliver et al., 2010; Rickwood et al., 2007; X. Wang et al., 2020). Further, in a meta-analysis, Xu et al. (2018) found that interventions with strategies to promote mental health literacy, destigmatisation or motivational enhancement had positive effects on mental health help-seeking behavior. This emphasizes the importance of both the availability and delivery of interventions on university campuses that promote mental health help-seeking behavior, and professional help offers for students with mental health problems (including university counseling services, psychotherapy). Several studies have shown that internet-delivered cognitive behavior therapy (ICBT) is effective for a range of mental health issues such as anxiety disorders and depression (e.g., Andersson, 2009; Andersson et al., 2013; Dagöo et al., 2014; Zhang and Ho, 2017). To prevent the spread of infections during the pandemic, it seems to be worthwhile to use ICBT to help students with psychiatric and health-related problems (Ho et al., 2020).

The study found no differences between students from high incidence areas and students from lower incidence areas in depression, anxiety or stress. These findings are in line with the results of previous studies that found no significant differences between participants from North Italy with the highest prevalence of contagion and deaths, and participants from Central and South Italy in regard of anxiety and post-traumatic stress disorder (Casagrande et al., 2020; Forte et al., 2020). Forte et al. (2020) assumed that the psychological status is influenced by direct effects (e.g., justified fear of infection) but also by indirect effects (e.g., implemented restrictions on public and social life) of the COVID-19 pandemic that influenced people of all areas, promoting similar mental health issues and stress.

Participants also reported their worries regarding COVID-19. The main concern was about the health of relatives, followed by worries about overburdened hospitals. Other concerns were about their study, their financial situation, and their liberty rights. Compared to other worries, students were not very afraid about their own health. These results are consistent with the findings of Lukács (2021), who found in a Hungarian student sample that students were most worried about the health of their personal network, followed by concerns about the efficiency of health care but they were not very concerned about their own health. Similar findings were in a study of Israeli and Ukrainian students' concerns during COVID-19 pandemic (Schiff et al., 2020). One reason that students were not very worried about their own health at the beginning of the COVID-19 outbreak could be due the reports that young people were less likely to have severe cases of the disease or to die from it (Jordan et al., 2020; RKI, 2021). Further, continuous broadcasting about overburdened hospitals could be another reason that young people are more worried about the situation of the hospitals. One study has shown that the exposure to media coverage of the coronavirus pandemic was associated with the COVID-related worries in Israeli and Ukrainian student samples (Schiff et al., 2020).

Results of the regression analyses showed that mindfulness was the most relevant protective factor against depression, anxiety and perceived stress. Optimism emerged as the next protective factor for all three variables. Mindfulness and optimism have been linked in several previous studies to better mental health outcomes and lower perceived

stress among student samples (e.g., depression, anxiety; Bodenlos et al., 2015; Brown and Ryan 2003; Kapikiran and Acun-Kapikiran, 2016; Sha et al., 2006). Further, meta-analyses and systematic reviews with focus on student samples have shown that mindfulness and mental health can be enhanced through mindfulness-based interventions (e.g., Bamber and Schneider, 2016; Halladay et al., 2019; Kiken et al., 2015). Moreover, Heckenberg et al. (2019) found that an online mindfulness-based program for employees significantly increased optimism. Consistent with and extending previous findings (e.g., Cao et al., 2020; Sun et al., 2021; Wasil et al., 2021), the results of the study showed that active coping was a protective factor against depression and stress, whereas social support was a negative predictor for depression. Although satisfaction with social support played a protective role against depression and stress, there was no significant effect on anxiety. Acceptance was a protective factor against anxiety and stress. Further, nearly 62% of the students in the current study were interested to take part in a mindfulness-based intervention and/or stress management training. Thus, prevention strategies that promote healthy coping skills, mindfulness and mental health during the current crisis are required on university campuses (e.g., Bai et al., 2020).

Additionally, COVID-related stressors such as being stressed by the Corona-pandemic, being worried about study and financial problems, and quarantine experience were risk factors for all outcome variables. Similar findings were reported in previous COVID-19 studies on anxiety (e.g., Cao et al., 2020; Huang and Zhao, 2020), which have shown that worries about academic delays and financial problems as well as concerns about the COVID-19 outbreak were positively associated with anxiety in Chinese students and general populations samples. Further, the result on quarantine is in line with earlier COVID-19 research (e.g., Wang et al., 2021) and previous studies on the impact of quarantine during severe acute respiratory syndrome (SARS) outbreak (e.g., Bai et al., 2004; Wu et al., 2009) that found a higher prevalence of mental health problems (e.g., depression, anxiety, posttraumatic stress disorder) after quarantine. The present study also detected that feeling stressed by the media reporting was a significant risk factor for depression and stress, thereby extending previous studies that found a positive relationship between Corona-related media exposure and mental health issues (e.g., Bendau et al., 2021; Gao et al., 2020; Veer et al., 2020). Although there is evidence for a detrimental role of media exposure during COVID-19 outbreak (e.g., Bendau et al., 2021; Gao et al., 2020), individual information processing styles seems to be important in this context. Bazán et al. (2020) found that psychological distress symptoms were higher among respondents with a negative information processing style when dealing with information overload compared to those with a more positive style.

Neuroticism was another risk factor for depression, anxiety, and stress, consistent with the findings of a study by Qian and Yahara (2020) during COVID-19 pandemic, and previous longitudinal research that found that persons high in neuroticism were more likely to develop mental health issues following negative life events (e.g., Hutchinson and Williams, 2007; Parslow et al., 2006). Finally, demographic variables (older age, being female) were associated with higher levels of depression or stress. However, mixed results have been obtained for gender. For example, Elmer et al. (2020) found that female students experienced higher levels of stress than male students, whereas Fu et al. (2021) reported no significant difference in gender regarding stress.

#### 4.1. Limitations and future research directions

Several limitations of the study need to be considered. First, this study used only self-report questionnaires to measure psychiatric symptoms and did not make clinical diagnosis. The gold standard for establishing psychiatric diagnosis involves structured clinical interviews and functional neuroimaging (Husain et al., 2020a; Husain et al., 2020b). Second, the majority of the students were women, which limits the generalizability of the results to men. Third, given the cross-sectional

study design, causal inferences cannot be drawn. Future research should use a longitudinal approach to investigate the courses of mental health issues and stress among students during the pandemic, and the associations of possible risk and protective factors with these variables.

Finally, vaccinating the general population (including also students) against COVID-19 as the next step in the fight against the disease COVID-19, future studies should also address students' views towards COVID-19 vaccine. A first study reported that 14% of the students showed low intention to vaccinate (Barello et al., 2020). Thus, future research that identifies variables associated with COVID-19 vaccine hesitancy is needed (e.g., Chew et al., 2021; Soares et al., 2021).

In sum, in line with the results of previous research, the current study found higher prevalence rates of mental health issues and stress among students during the COVID-19 pandemic when compared to the prevalence rates before the crisis. Further, the results indicated that mindfulness, optimism, and coping strategies were protective factors, whereas COVID-related stressors (e.g., worries about study and financial problems, being stressed by the Corona-pandemic and media reporting, quarantine experience) as well as personal characteristics (e.g., neuroticism, older age, being female) were risk factors for mental health issues and/or stress among students. Therefore, universities should provide psychological professional services (e.g., counselling, hotlines, therapy offers) adapted to these circumstances as well as prevention programs (e.g., stress management trainings, mindfulness-based interventions) that promote healthy coping skills, mental health help-seeking behavior and mental health.

#### Declaration of Competing Interest

The author declares that there is no conflict of interest regarding the current paper.

#### Funding

None.

#### Author contributions

CK designed and executed the study, analyzed the data, and wrote the paper.

#### Acknowledgements

None.

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