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Perceived stress and depressive symptoms among students during COVID-19

Bachelor thesis

By Emma Simons

(s2188856)

Faculty of Behavioral Management and Social Sciences (BMS)

Department of Psychology

First supervisor: Alexandra Ghiţă

Second supervisor: Mirjam Galetzka

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Abstract

Introduction

The world population is currently faced with the coronavirus disease 2019 (COVID-19) caused by The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). To reduce the spread of the virus, several measures have been taken. Due to social isolation, online education and several other factors, the mental well-being of students has been affected. Therefore, this study aims to explore the mental well-being of students during COVID-19 and more specifically the perceived stress rates and depressive symptoms.

Method

As for the design of the study, an analytical cross-sectional survey study was performed. The participants were recruited using convenience sampling. In total, the data of 216 participants was used in this study. The participants were between the age of 18 to 32 years old, had to have a sufficient command of the English language and currently enrolled in a University or a University of Applied Sciences. To measure the perceived stress rates, the 10 item Perceived Stress Scale (PSS-10) was filled out by the participants. To measure depressive symptoms, the Beck Depression Inventory II (BDI-II) was administered.

Results

The results of this study first of all showed significant moderate perceived stress rates among students during COVID-19. Further, depressive symptoms regarding loss of energy, sleep pattern and concentration increased during COVID-19. Lastly, significant differences between males and females regarding depressive symptoms during COVID-19 were found and females scored significantly higher on depressive symptoms compared to males.

Conclusion

To conclude, this study aimed to explore the mental well-being of students during COVID-19. The results showed that the mental-wellbeing regarding perceived stress and depressive symptoms of students has been affected during COVID-19. Further, females show more depressive symptoms during COVID-19 compared to males.

Keywords: COVID-19, depression, students, university students, perceived stress, gender differences.

Introduction

Perceived stress and depressive symptoms among students during COVID-19

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) which causes the coronavirus disease 2019 (COVID-19) was first recognized in December 2019 and the first 425 cases were reported in the "epicenter'' of the outbreak: the city of Wuhan, China (Fauci, Lane, Redfield, 2020). By the 29th of March 2019, COVID-19 had already spread to 177 countries and more than 722,435 patients were infected which resulted in more than 33,997 deaths. On the 29th of April 2021 there were already 148 million cases of infection and 3,14 million deaths caused by COVID-19 (World Health Organization, WHO, 2021). Besides the deaths and increasing infection rates, Covid-19 has significant consequences on the economy, financial markets, corporate offices, businesses and events were shut down and unemployment rates soon started to rise after two months (Fairly, Couch & Xu, 2020; Ozili, 2020). Further, COVID-19 has affected the psychological status of the individual and the virus facilitated the development of mental health concerns worldwide (Cullen, Gulati & Kelly, 2020). Whilst researchers are continuing to develop and revise vaccines to counteract the effects of Covid-19, officials of several countries implemented restrictions to ensure physical distancing to decrease the spread of the virus. This physical distancing includes stay at home orders, travel restrictions and the closing of non-essential businesses, including gyms, museums, movie theaters and places where large groups gather (Gostin & Wiley, 2020).

Mental well-being during COVID-19

The period of COVID-19, the quarantine measurements, the uncertainties and the fears that come with a outbreak have already proven to have an effect on mental health in the general population (Xiong et al., 2020; Serafani et al., 2020). Rates of mental health concerns and disorders have increased since the outbreak of the virus, including stress, anxiety, post-traumatic stress disorder, substance misuse or depression, leading to overall psychological distress (Xiong et al,2020).

More and more research suggests that reactions related to stress are occurring during COVID-19 in the general population (Cooke, Eirich, Racine & Madigan, 2020). This stress is a response to internal and external threats of COVID-19, the extent to which a person can cope with these stressors (Liu et al., 2020) and also the unpredictable and uncontrollable nature of the disease (Cooke, Eirich, Racine & Madigan, 2020). Examples of these stressors are the physical distancing measures, psychosocial stressors such as financial strain and isolation (Liu

& Doan, 2020) and also the fear of infection for the person self and the possible infection of a loved one (Schimmenti, Billieux & Starcevic, 2020). The alarming results of these stressors during COVID-19 can be seen in the prevalence of stress among the general population. Stress associated with COVID-19 has a prevalence of 23.1% and one in four adults require mental health services to cope with this stress (Cooke, Eirich, Racine & Madigan, 2020). A meta-analysis also showed that stress had a prevalence of 29.6% during COVID-19, based on five studies (Salari et al., 2020). However, stressors also have long-term consequences that raise concern. Elevations in general stress rates have an impact on mental health difficulties and can also lead to chronic health diseases. For example, stress that is improperly treated can lead to drug misuse, violence, family conflict, but may also facilitate the development of chronic conditions like cardiovascular diseases and cancer (Quick, Horn & Quick, 2008). Further, several studies indicated that perceived stress has been an important variable in determining anxiety related responses (Zvolensky et al., 2010), learning deficits and memory loss, posttraumatic stress disorders (Esch et al., 2002) or depression (Praag van, 2004). With the high prevalence of stress during COVID-19, the consequences of stress are concerning. Consequently, the rates of several mental health difficulties have risen during COVID-19 (Xiong et al., 2020).

There also is a higher prevalence of depression in the general population as a consequence of Covid-19. Studies have shown that the rates of depression during COVID-19 are alarming (Salari et al., 2020; Xiong et al., 2020). The prevalence of the depression disorder during COVID-19 is 33.7 % and depressive symptoms have increased from 14.6 % to 48.3% among the general population during COVID-19 (Salari et al., 2020; Xiong et al., 2020). The cognitions of individuals suffering from depressive symptoms refer to personal worthlessness, failure, incompetence and pessimism (Greenberg & Beck, 1989). Three mechanisms are proposed to explain the cognitive processes that results in emotional dysregulation in depression. These consist of inhibitory processes and deficits in the working memory, the inability to use positive and rewarding stimuli to regulate negative states and moods and lastly an apprehensive response to negative states and moods (Gotlib & Joormann, 2010). Individuals who do not suffer from depressive symptoms have schemas that are build up from positive information, whereas individuals suffering from depressive symptoms have cognitions that are composed of negative self-schemas and negative depression-relevant information (Greenberg & Beck, 1989; Gotlib & Joormann, 2010). There are different subtypes of depression. In the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric

Association, APA, 2013), depressive disorders consists of eight different subtypes; disruptive mood dysregulation disorder, major depressive disorder (major depressive episode included), persistent depressive disorder, premenstrual dysphoric disorder, substance medication-induced depressive disorder, depressive disorder due to another medical condition, other specified depressive disorder and lasty unspecified depressive disorder. Within these subtypes, the common cluster of symptoms can be seen in the presence of an empty, irritable sad mood, along with both cognitive and somatic changes that have a significant effect on the functioning of the individual. The factors that separate the different subtypes are timing, duration or the presumed etiology (APA, 2013). Individuals who suffer from depressive symptoms have persistent feelings of hopelessness, sadness and a loss of interest in activities that they used to enjoy (Truschel, 2020). Physical symptoms can also be present in individuals who suffer from depression, such as chronic pain and issues with digestion (Truschel, 2020). The underlying mechanisms of depression are explained by different models. The *cognitive model* proposes that biased attention is the underlying mechanism, individuals who suffer from depression selectively attend to negative stimuli (Disner, Beevers, Haigh & Beck, 2011). This bias is also present in the experience of perception, memory and self-schemas of the individual (Disner, Beevers, Haigh & Beck, 2011). The risk of depression can also be explained by coping protective factors such as social support seeking, self-blame and avoidance. Further, high levels of anger and hostility also predict a risk for depression (Ingram, Trenary, Odom, Berry & Nelson, 2002). Untreated depression can have several consequences. Depression has been proven to increase the risks of strokes, cardiovascular diseases, diabetes, obesity morbidity and to a lesser extent even cancer (Penninx, Milanschi, Lamers & Vogelzangs, 2013). Further, comorbidity between depression and drug abuse is also well established with a high level of co-occurrence (Volkow, 2004).

Mental well-being of students during COVID-19

Looking at the demographics within the general population, students have been severely impacted by the outbreak of the virus (Aucejo, French, Araya & Zafar, 2020). A great number of universities across the world have cancelled and postponed all on campus events such as educational activities, workshops, conferences and sport to decrease the spread of COVID-19. Universities have taken these measures to protect their students from the highly infectious disease and this has an impact on more than 80% of the world's student populations (Sahu, 2020). Universities have switched from face to face lectures and tutorials to online delivery of programs and courses. The uncertainty that this brings has already been shown to have a great

effect on the mental health of students and has led to anxiety and significant levels of stress among university students during Covid-19 (Sahu, 2020; Satici, Saricali, Statici & Griffiths, 2020). Students themselves indicated to experience higher levels of stress, they worry about the disadvantages of online education and are afraid that they will suffer from this in the long-term when being compared to on-site educated students (Daniel, 2020). With the increase of online education, more students are spending time alone. All of these measures lead to a social isolated environment. Previous research has shown that online education leads to a lower quality of interactions (Dumford & Miller, 2018) and although students enjoy the flexibility of online education, reportedly the worst aspect is social isolation, having the feeling of being alone and the lack of a real-life connection (Rush, 2015). Social isolation has already been shown to have a negative effect on the mental-wellbeing of students (Lukács, 2021). Students without preexisting mental health issues before Covid-19 show increasing mental health issues during the pandemic. Compared to a year earlier, students now show increased degrees of sadness, depressive symptoms and anxiety symptoms. Students for example showed more depressive-related-symptoms such as poor sleep, feelings of hopelessness and feelings of loneliness during social isolation (Tang et al., 2020). Social isolation has been proven to be the key factor in the increase of these mental health concerns (Hamza, Ewing, Heath & Goldstein, 2021).

Due to cancelled physical activities, students have less personal contact with friends and study peers. Next to physical education, their sports team, project group and friend group that they used to have direct contact with has either switched to meeting online or cancelled fully**.** Universities have also cancelled social events, where students would usually meet new people and gather with friends. For example introduction weeks where new students have the opportunity to meet peers and also festivals, big sport events and events of study associations. The social network of students has been proven to be an important factor in boosting students' mental well-being (Mason, Zaharakis & Benotsch, 2013). Due to the social distancing measures imposed by governmental policies, the social isolation of students is increasing. The reduction of social interactions, together with lack of social support and in combination with new arising stressors because of COVID-19 pandemic students' mental health is affected negatively (Elmer, Mepham, Stadtfeldt 2020). University students notice this increase in mental health issues themselves, 83% of the respondents of a study done by Young Minds (2020) agreed that pre-existing mental health issues have gotten worse due to new stressors that occurred during the outbreak.

As illustrated above, university students are a particular susceptible group in terms of mental health problems and this is also seen in the level of stress that students perceive during COVID-19 (Husky, Kovess-Masfety, Swendsen, 2020). A study done by AlAteeg, Alijhani en AlEasa (2020) showed that 58.1% of students feel fairly or very stressed during the outbreak. The students felt anger towards what was happening outside of their control and were experiencing increasing difficulties with unexpected changes (AlAteeg, Alijhani & AlEasa, 2020). Another study also showed that compared to pre-pandemic semester in the fall of 2019, more perceived stress was reported in university students that completed the study in the beginning of the pandemic in spring 2020 (Charles et al., 2020). As to gender differences among students, females scored significantly higher on perceived stress levels compared to males (AlAteeg, Alijhani & AlEasa, 2020). The increasing numbers of perceived stress amongst students may have negative consequences. First of all, stressful life events have proven to have a strong relationship with reduced academic performance (Khan, Altaf & Kausar, 2013). Students reported that amongst all of the health factors involved in academic achievements, stress impacted this achievement the most (Khan, Altaf & Kausar, 2013). Further, it was found that experiencing stressful life events is associated with drug abuse among students. Studies showed that 40% of respondents that had used a drug in the past month were experiencing high or very high levels of psychological distress. They use the legal or illegal drug to escape from the pressures that life brings such as a stressful life event, despite the health risks and enhanced suicide risks. (Rose & Bond, 2009; Peter, Marzuk & Mann, 1988). Lastly, severe and prolonged perceived stress itself is also an established risk factor for suicidal behavior and with suicide being the second leading cause of death among college students, this is alarming (Hirsch, Rabon, Reynolds, Barton & Chang, 2019).

Next to perceived stress levels, depressive symptoms have also increased among university students just as in the general population during COVID-19. At any given time, 25% of university students report depressive symptoms (Kumaraswamy, 2013). During COVID-19, the prevalence of depression among students has increased to 33.7%, more than stress (29.6%) and anxiety (31.9%) (Salari et al., 2020). Furthermore, a study showed that both male and female university students report increased depressive symptoms as a result of social distancing measures (Liu, Zhang, Yang & Yu, 2020), particularly for students with limited personal networks (Elmer, Mepham, Stadtfeldt, 2020). A low security of friendship, caused by distancing, subsequently has been proven to be related to more depressive symptoms (Mason, Zaharakis & Benotsch, 2013). Studies have demonstrated that individuals with depressive

symptoms have a higher likelihood to experience suicidal thoughts (Dvorak, Lamis & Malone, 2013), severe alcohol and drug misuse (Dennhardt & Murphy, 2011; Weiss, Griffin & Mirin, 2009), and poor overall health (Ruo, Rumsfeld, Hlatky et al., 2003).

As seen above, there are negative effects regarding the overall mental health and depressive symptoms. During COVID-19 the general mental health concerns among university students has increased and because of the alarming effects it is important that the mental wellbeing of students during COVID-19 is explored. Especially it is important to explore depressive symptoms because of the long-term implications on personal and societal levels. The general objective of this study is therefore to explore the effect of COVID-19 on the perceived stress and depressive symptoms of students. A secondary objective is to assess whether there is a difference between males and females regarding depressive symptoms during Covid-19. Together, the objectives of this study will add to the research whether COVID-19 affects the mental well-being of students and with this information it can be assessed whether measurements should be taken to reduce the effect of the pandemic. To explore the mental well-being of university students during COVID-19 the following research questions (RQ) and hypothesis' will be investigated.

RQ_1: What is the impact of COVID-19 pandemic on university students' mental well-being?

- Hypothesis 1: University students report moderate rates of perceived stress during the COVID-19 pandemic.
- Hypothesis 2: Depressive symptoms regarding loss of energy, sleep pattern and concentration have significantly increased in university students as a result of the COVID-19 pandemic.

RQ_2: Are there gender differences regarding depressive symptoms in university students during COVID-19?

- Hypothesis 3: There are significant differences between male and female students in terms of depressive symptoms during the COVID-19 pandemic.

RQ_3: What is the relationship between perceived stress and depressive symptoms among students during the COVID-19 pandemic?

- Hypothesis 4: There is a positive relationship between perceived stress and depressive symptoms among students during the COVID-19 pandemic.

Methods

Design

As to the design of the study, an analytical cross-sectional survey study was performed. This was done by conducting an online survey that was distributed amongst university students. The participants were recruited through convenience sampling.

Participants

In total, 362 students participated in the study with ages ranging between 18 and 32 years old. The participants had to be at least 18 years old to be included in the study, had to have a sufficient command of the English language and currently enrolled in a University or a University of Applied Sciences. Based on all of these inclusion criteria 146 people did not meet the criteria. Further, there were individual variables that the participants were asked. These variables consisted of age, gender, nationality, previous mental health problems and also if the participant was previously infected by the SARS-COV-2 virus. To recruit participants, the SONA system of the University of Twente was used, peers were contacted and the survey was uploaded on social media platforms. When participants filled in the survey via the SONA system, they received credits. The survey was open for participation from the 9th of April 2021 until the 10th of May 2021. The participants all signed an informed consent form. Before the gathering of data the study was approved by the Ethical Committee with request number 210233. Lastly, participation in the study was voluntary.

Instruments

To explore the mental well-being of university students during COVID-19, a survey was created in Qualtrics. The questionnaire explored the demographics and individual variables such as previous and current mental health, the perceived stress and depressive symptoms of students.

Demographic questions. At the beginning of the survey, several background questions were asked regarding the demographics of the participants. This part of the survey consisted of eight questions in total. Of these questions, there were two open questions which covered age and country of origin, the other six closed ended questions regarded gender and their current enrollment in a university or a university of applied sciences. Due to the study being about the period of COVID-19, a question whether the participant is infected or was previously infected by the SARS-COV-2 virus was also asked. Questions about whether they were ever diagnosed with a mental health condition and if they had ever sought psychological or pharmacological treatment for mental health concerns were also part of the demographic questions.

Perceived stress. The self-perception of stress among university students during COVID-19 was measured with the Perceived Stress Scale (PSS) (Cohen, Kamarch & Mermelstein, 1983). The PSS is a self-reported questionnaire which measures the degree that individuals perceive a situation in their life as stressful. The items of the scale measure the extent to which individuals evaluated their life as uncontrollable, unpredictable and overloaded in the past month (Lee, 2012). In this study, the version of the PSS scale with 10 items was used (PSS-10). This version of the PSS uses a five point Likert scale (Lee, 2012), ranging from never (0) to very often (4) (Cohen, Kamarck & Mermelstein, 1994). The internal consistency of the PSS-10 is evaluated with a Cronbach's alpha of 0.75 (Huang et al., 2020) and therefore has a good internal consistency. Further, the test-re-test reliability of the PSS-10 is good (r = .77) (Remor, 2006). The total scores from the PSS-10 range from 0 to 40 and higher scores represent higher levels of perceived stress (Cohen, Kamarck & Mermelstein, 1994). Further, scores ranging from 0-13 are considered as low stress, scores from 14-26 moderate stress and scores between 27-40 are considered as high perceived stress. To use the PSS in the data analysis, questions 4, 5, 7 and 8 required reversed coding.

Depressive symptoms. To explore the effect of COVID-19 on depressive symptoms among university students, the Beck Depression Inventory - II was used. The BDI-II consists of 21 items which measure depressive symptoms and characteristic attitudes through self-reported ratings (Beck et al., 1961). The items assess cognitive, behavioral, affective and somatic components of depression. It makes use of a four point Likert scale (Beck, Steer & Brown, 1996). The internal consistency of the BDI-II is measured with a 0.9 alpha coefficient which indicates an excellent internal consistency (Wang & Gorenstein, 2013) Further, the test-re-test reliability is also shown to be stable with a Pearson's r ranging between 0.73 and 0.96 in several studies. Moreover, higher scores indicate higher levels of depression (Wang & Gorenstein, 2013; Teri, 1982). As for the cut off scores, scores between 0 and 13 indicate minimal depression; 14 and 19 mild depression; 20 and 28 moderate depression and scores between 29 and 63 indicate severe depressive symptoms. Consequently, the total score ranges from 0 to 63.

Ad-hoc items. Further, three items were withdrawn from the BDI-II to compare the scores of these depressive symptoms before and during COVID-19 and were adapted to the scope of this study. The items concerned loss of energy, sleep pattern and concentration. To measure the scores before COVID-19 the formulation for the items was slightly adapted to

persuade the participants to think about their loss of energy, sleep pattern and concentration before COVID-19.

Procedure

The survey used in this study was created using Qualtrics. Before starting the survey, participants were informed that the aim of the study was to explore their mental well-being during COVID-19 and that several concepts were going to be measured. They were also asked to give an informed consent in which it was stated that their data was anonymous and that it was confidential. Also, their participation in the study was voluntary. After this information was given and agreed upon, the survey was filled in by the participant. First of all, the demographic questions were filled out. Next, the general mental well-being of the participant was measured by the PSS. After this different concepts were measured, including the focus of this study; depressive symptoms. Depressive symptoms of the participants were measured with the BDI-II. As for the duration, the survey took approximately fifteen to twenty minutes for the participants to fill it in. After completing the survey, the participants were thanked for their response.

Data analysis

The data collected in Qualtrics was first converted to SPSS and the participants who did not meet the inclusion criteria were removed. After all the data was prepared, descriptive statistics were conducted to explore the demographic information of the participants. With these descriptive statistics, age, gender, level of education and nationality were explored. The descriptive statistics were also used for the questions whether the participant was ever infected with the SARS-COV-2 virus, whether the participant ever sought psychological or pharmacological treatment for mental health concerns and if the participant ever been diagnosed with a mental health condition.

Next, the normality of the data was explored with Shapiro-Wilk test and QQ plots. For perceived stress, the Shapiro-Wilk test showed that the data was normally distributed ($p = .28$). For the BDI-II The Shapiro-Wilk test indicated that the data was not normally distributed ($p = .00$), however a visual inspection of QQ plots showed normally distributed data with no significant deviations (see QQ plot in appendices), therefore parametric tests were employed to address all the hypotheses.

As for the first hypothesis, the total score of the PSS was first calculated. Further, the scores were divided in the three categories of the cut off scores to see which students had *low*,

moderate and *high* perceived stress. To test the hypothesis, descriptive and frequency analyses were carried out regarding total PSS-10 scores.

As for the second hypothesis, the total score of the BDI-II was first calculated. To test the hypothesis, a repeated measure ANOVA was used on the each of the three items that were asked twice in the questionnaire to test the symptoms regarding loss of energy, sleep pattern and concentration ability before and during COVID-19.

As for the third hypothesis, a t-test for independent samples was run to test the differences of males and females regarding depressive symptoms. For this, the total score of the BDI-II was used.

Lastly the fourth hypothesis, a Pearson's correlation was conducted using the total scores of the PSS-10 and the BDI-II.

Results

The data of 216 participants was used for the analyses. In total there were 60 males, 154 females and two people that indicated 'other' for their gender. The mean age of the participants was 21.73, 40 participants had sought psychological or pharmacological health before, 28 participants indicated to have been diagnosed with a mental health concern and 20 participants were infected with the SARS-COV-2 virus since the beginning of the pandemic (see Table 1).

Table 1

Descriptive data of variables of interest.

Participants' Characteristics	N (216)	M/(SD)/%	Minimum	Maximum
Gender				
Female	154	71.3%		
Male	60	27.8%		
Other	2	0.9%		
Country of origin				
Dutch	29			
German	147			
Other	40			
Age	216	21.73(1.9)	18	32
Infection with Covid-19				

Yes	20	9.3%		
No	196	90.7%		
Psychological/ Pharmalogical treatment				
Yes	40	18.5%		
No	176	81.5%		
Diagnosed with a Mental Health condition				
Yes	28	13%		
No	188	87%		
Depressive symptoms	216			
Total score	216	14.6(10.5)	0	53
Minimal (0-13)	112	51.9%		
Mild (14-29)	56	25.9%		
Moderate (20-28)	26	12.0%		
Severe (29-63)	22	10.2%		
Perceived stress				
Total score	216	21.6(7.1)	2	39
Low (0-13)	31	14.4%		
Moderate (14-26)	140	64.8%		
High (27-40)	45	20.8%		

Note. M= mean, SD= standard deviation

Concerning H_1, descriptive and frequency analysis indicated that there was a high prevalence of moderate perceived stress in the sample of the current study (*M= 21.58, SD= 7.06)* (see Table 1). Further, 14.4% of the 216 students showed low perceived stress, 64.8% showed moderate perceived stress and 20.8% of the students reported high rates of perceived stress. Therefore, the first hypothesis was accepted.

Regarding H_2, a repeated measures ANOVA indicated that for the first item the symptoms of loss of energy significantly increased $F(1, 215) = 187.86$, $P < .001$) (see Table 2). For the second item regarding sleeping pattern, there was also a significant increase $F (1, 215) = 46.51$, $P < .001$) (see Table 2). Lastly, the third item about concentration also showed a significant increase $F(1, 215) = 222.86$ $P < .001$) (see Table 2). Therefore, the second hypothesis was also confirmed.

Table 2

Gender differences regarding depressive symptoms during COVID-19 and differences in depressive symptoms before and during COVID-19.

Characteristic	Depressive symptoms during COVID-19	
	M	SD
Gender		
Female	15.79	10.51
Male	11.1	9.26

	Before COVID-19		During COVID-19		F(p)
	M	SD	M	SD	
Depressive symptoms					
Loss of energy	.27(.59)	.59	1.16(.8)	.8	187.86(< .001)
Sleeping pattern	.53(.81)	.81	.96(.76)	.76	46.51(< .001)
Concentration	.23(.53)	.53	1.18(.95)	.95	222.86(< .001)

Note. Difference in depressive symptoms before and during COVID-19 n=216, difference in depressive symptoms between females and males n=214.

To assess H_3 , an independent sample t-test on the data of the whole BDI-II (see Table 1) (n=214) showed a significant difference between the scores of females (*M= 15.79, SD= 10.51*) and males (*M= 11.1, SD= 9.26*). Females obtained significantly higher scores on depressive symptoms $t(212) = -3.03$, $p = 0.03$ (see Table 2), therefore the third hypothesis is also confirmed.

Lastly, concerning H_4 a Pearson's correlation showed a significant positive relationship between perceived stress and depressive symptoms $r(214) = 0.73$, $p = <.001$. Therefore the hypothesis is confirmed.

Discussion

In this research, the impact of the period of COVID-19 on the mental health of students regarding perceived stress and depressive symptoms was explored. The results of this research showed that there was a significant effect of COVID-19 on the mental health of students. To be more specific, it was found that (1) university students show moderate rates of perceived stress

during the COVID-19 pandemic; (2) isolated depressive symptoms have increased in university students as a result of the COVID-19 pandemic; (3) there are significant differences between male and female students in terms of depressive symptoms during the COVID-19 pandemic.

The results of this research confirmed the hypothesis that students experience moderate perceived stress during COVID-19. The results were also in line with previous research. First of all, AlAteeg, Aljhani & Aleesa (2020) used the PSS-10 as well to measure the perceived stress among students during the COVID-19 outbreak and in line with this study found that 55% of the students showed moderate perceived stress during COVID-19. Further, a study done by Aslan & Pekince (2020) also showed that students experienced a moderate level of stress during COVID-19 with an average score of 28.1 on the Perceived Stress Scale (PSS-14) indicating that the COVID-19 pandemic negatively affects the stress level of students. These results and the level of stress among students during COVID-19 can be explained by various research. First of all, it has been proven that social relationships are important moderators for stress. If an individual has a difficult time with creating social contact, stress can be present (Bhargava & Trivedi, 2018). During COVID-19, students have had difficulty in creating new friendships and psychically seeing their social contacts, which can explain the levels of stress experienced by the students. Further, students cope with stress through leisure activities and exercising (Pierceall & Keim, 2007). During the pandemic most sport events, on campus educational events and other activities have been cancelled. Due to this, students were unable to use these activities to cope with stress, the stress levels found in students in this research can also be explained. Lastly, students also experience new stressors during COVID-19 such as having the fear of becoming infected or fear for a family member and dealing with difficulties and frustrations of online learning (Fawaz, Nakhal & Itani, 2021).

Further, this research showed that depressive symptoms regarding energy, sleep pattern and concentration increased during COVID-19. Previous research already showed that sleep problems are common among college students and that it is an indicator of health. Students who often suffer from sleep problems are associated with serious depressive symptoms (Yu, Tian, Cui & Wu, 2021). During COVID-19, the sleep quality of students has worsened which could explain the increase in the depressive symptoms (Marelli et al., 2021). Research done by Son, Hegde, Smith, Wang & Sasangohar (2020) also showed students to have more difficulties concentrating during COVID-19 which is also one of the findings of this study. Further, students were also worried about the health of their family members and themselves due to COVID-19, leading to more depressive symptoms in general (Yu, Tian & Wu, 2021). Students

experience stress due to online education and this has been previously proven to lead to higher prevalence of depressive symptoms (Waakter, Borge, Fundingsrud, Johnsen & Torgersen, 2004). Also mentioned before were the cancelled social activities of students during COVID-19, research on depressive symptoms during COVID-19 indicated that students whose social interactions were affected had a higher prevalence of depressive symptoms (Yu, Tian & Wu, 2021) The social isolation during the pandemic can therefore explain the higher rates of depressive symptoms compared to before COVID-19.

Furthermore it was found that there are significant differences between females and males regarding depressive symptoms during COVID-19. Several other studies investigating adult populations also reported that females experience more depressive symptoms compared to males (Bracken & Reintjes, 2010). The results during COVID-19 can also be explained by previous research. First of all it has been shown that stressful life events have a stronger negative effect on depressive symptoms on females than on males (Bodecka et al., 2021). During COVID-19 students have been experiencing stress due to online education, social isolation and worrying about health problems , this can explain the higher depressive symptoms for females students in this study compared to males (Bracken & Reintjes, 2010). Further, females rely more on social support than males (Ang & Malhotra, 2016). During quarantine, social interactions have decreased due to cancelled on campus events, sport events and other activities. This can have a negative effect on the social support that female students experience which can increase depressive symptoms (Flaherty & Richman, 2010).

However, this research showed that for both male and female students depressive symptoms were present. During COVID-19, most leisure activities were cancelled which resulted in less distraction in the area of study but more focus on the pandemic itself. This might explain why males also showed significant depressive symptoms during COVID-19 as a study done by Garnefski, Teers, Kraaij Legerstee & Kommer (2004) showed that males and females both frequently use the cognitive coping strategy of positive reappraisal and search for distractions when suffering from depressive symptoms. Furthermore, a study showed that both male and female university students report increased depressive symptoms themselves as a result COVID-19 (Liu, Zhang, Yang & Yu, 2020)

Lastly, a significant positive relationship between perceived stress and depressive symptoms among students during COVID-19 was found. This was expected and not surprising as previous studies indicated the same result. For example, a study done by Nathan & Sheets

(2020) showed that perceived stress and depressive symptoms positively correlated at both baseline measures and a one month follow up.

Strengths and limitations

This study contains several strengths. First of all, the sample size was large (N=216) which has a positive influence on the reliability of the results. Secondly, until now not many studies explored gender differences regarding depressive symptoms during COVID-19 however there are significant differences which can help with prevention and finding prevention measures and adequate mental health support for depressive symptoms during COVID-19. Lastly, mental health was analyzed on both stress and depressive symptoms, providing a better overview of the mental health of students.

Nevertheless, there were also some limitations in this research. One of the most important limitations is the gender imbalance. There were significantly more females who participated in this study compared to males, this could have had an effect on the prevalence rates of both depressive symptoms and perceived stress and because of the gender imbalance not thoroughly represent overall students because females also already scored significantly higher than males on depressive symptom. Further as to perceived stress, the PSS was only measured during COVID-19. Because of only measuring the perceived stress during COVID-19 it is difficult to conclude that the rates of perceived stress are a result of the COVID-19 pandemic. Additionally, only three questions of the BDI-II were used for the comparison of depressive symptoms of before and during COVID-19, which does not explore overall depressive symptoms but measures those three isolated depressive symptoms. This should be taken into account when looking at the results of the difference in the depressive symptoms from before and during COVID-19.

Future research

After conducting this research there are several possibilities for future research. First of all, it can be proposed to assess mental well-being in a more comprehensive matter by using other instruments such as structured clinical interviews for major mental health disorders (SCID) to have an overall more realistic view of students' psychological status. Further, regarding the gender differences it can be investigated why females have more depressive symptoms than males during COVID-19 by using qualitative research instead of quantitative research. With qualitive research several factors that result in depressive symptoms can

investigated. For example focus groups can be created to collect the experiences and opinions of students their own mental well-being during COVID-19.

Personal development plans could be an option to help students cope with stressors that increase the risk of both depressive symptoms and increased perceived stress rates. Further, online group meetings can be organized where students discuss their difficulties to decrease the burden of social isolation. Also, online mindfulness can help in coping with the stressors. Lastly, there are apps available that can also help with psychological support from a distance.

Conclusion

To conclude, this research explored the mental well-being of students during COVID-19. According to this research, there is a high prevalence of moderate levels of perceived stress among university students during the COVID-19 pandemic. Further, depressive symptoms regarding energy, sleep and concentration have increased during COVID-19. Additionally, Females experience more depressive symptoms then males during COVID-19.

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Appendices

Appendix A

Demographic questions

Q3 Are you currently enrolled in a university or an applied university?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Are you currently enrolled in a university or an applied university? = No

Q4 What is the degree you are currently working on?

- ○ Bachelor (1)
- ○ Master (2)
- ○ PhD (3)

Q5 What is your age?

_____

Q6 What is your country of origin?

_____

Q7 What is your gender

- ○ Male (1)
- ○ Female (2)
- ○ other (4) _____

Q8 Since the beginning of the pandemic, have you been infected with SARS-COV-2 virus (causing the Covid-19 disease) ?

- ○ Yes (1)
- ○ No (2)

Q9 Have you ever sought psychological or pharmacological treatment for any mental health concerns (e.g. anxiety, depression, eating disorders)?

- ○ If yes, please indicate (1) _____
- ○ No (2)

Q10 Have you ever been diagnosed with a mental health condition? Yes/No, If yes, please mention:

- ○ if yes, indicate (1) _____
- ○ no (2)

Appendix B

Perceived Stress Scale (PSS-10)

Q42 The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way.

	0 = never (1)	1 = almost never (2)	2 = Sometimes (3)	3 = Fairly often (4)	4 = Very often (5)
1. In the last month, how often have you been upset because of something that happened unexpectedly? (1)	○	○	○	○	○
2. In the last month, how often have you felt that you were unable to control the important things in your life? (2)	○	○	○	○	○
3. In the last month, how often you felt nervous and "stressed"? (3)	○	○	○	○	○
4. In the last month, how often have you felt confident about your ability to handle your personal problems? (4)	○	○	○	○	○
5. In the last month, how often have you felt that things	○	○	○	○	○

were going your way? (5)					
6. In the last month, how often have you found that you could not cope with with all the things that you had to do? (6)	○	○	○	○	○
7. In the last month, how often have you been able to control irritations in your life? (7)	○	○	○	○	○
8. In the last month, how often have you felt that you were on top of things? (8)	○	○	○	○	○
9. In the last month, how often have you been angered because of things that were outside of your control? (9)	○	○	○	○	○
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? (10)	○	○	○	○	○

Appendix C

Beck Depression Inventory II

Q43 The following questionnaire consists of 21 groups of statements. Please read each group of statements carefully. Then pick out the one statement in each group that best describes the way you have been feeling during the **past two weeks, including today**. If several statements in the group seem to apply equally well, choose the one that fits you best. Be sure that you do not choose more than one statement for any group.

Q44 Sadness

- I do not feel sad (1)
- I feel sad much of the time (2)
- I am sad all the time (3)
- I am so sad or unhappy that I can't stand it (4)

Q45 Pessimism

- I am not discouraged about my future (1)
- I feel more discouraged about my future (2)
- I do not expect things to work out for me (3)
- I feel my future is hopeloiess and will only get worse (4)

Q46 Past Failure

- I do not feel like a failure (1)
- I have failed more than I should have (2)
- As I look back, I see a lot of failures (3)
- I feel I am a total failure as a person (4)

Q47 Loss of Pleasure

- I get as much pleasure as I ever did from the things I enjoy (1)

- I don't enjoy things as much as I used to. (2)
- I get very little pleasure from the things that I used to enjoy. (3)
- I can't get any peasure from the things I used to enjoy. (4)

Q48 Guilty feelings

- I don't feel particularly guilty. (1)
- I fee guilty over many things I have done or should have done. (2)
- I feel guilty most of the time. (3)
- I feel guilty all of the time. (4)

Q49 Punishment feelings

- I don't feel I am being punished. (1)
- I feel I may be punished. (2)
- I expect to be punished. (3)
- I feel I am being punished. (4)

Q50 Self-Dislike

- I feel the same about my self as ever. (1)
- I have lost confidence in myself. (2)
- I am disappointed in myself. (3)
- I dislike myself. (4)

Q51 Self-criticalness

- I don't critizize or blame myself more than usual. (1)
- I am more critical of myself than I used to be. (2)
- I criticize myself for all of my faults. (3)
- I blame myself for everything bad that happens. (4)

Q52 Suicidal thoughts or wishes

- I don't have any thoughts of killing myself. (1)
- I have thoughts of killing myself, but I would not carry them out. (2)
- I would like to kill myself. (3)
- I would kill myself if I had the chance. (4)

Q53 Crying

- I don't cry anymore than I used to. (1)
- I cry more than I used to. (2)
- I cry over every little thing. (3)
- I feel like crying but I can't. (4)

Q54 Agitation

- I am no more restless or wound up than usual. (1)
- I feel more restless or wound up than usual. (2)
- I am so restless or agitated that it's hard to stay still. (3)
- I am so restless or agitated that I have to keep moving or do something. (4)

Q55 Loss of interest

- I have no lost interest in other people or activities. (1)
- I am less interested in other people or things than before. (2)
- I have lost most of my interest in other people or things. (3)
- It's hard to get interested in anything. (4)

Q56 Indecisiveness

- I make decisions about as well as ever. (1)
- I find it more difficult to make decisions than usual. (2)
- I have much greater difficulty in making decisions than I used to. (3)
- I have trouble making any decisions. (4)

Q57 Worthlessness

- I do not feel I am worthless. (1)
- I don't consider myself as worthwile and useful as I used to. (2)
- I feel more worthless as compared to other people. (3)
- I feel utterly worthless. (4)

Q58 Loss of energy

- I have as much energy as ever. (1)
- I have less energy than I used to have. (2)
- I don't have enough energt to do very much. (3)
- I don't have enough energy to do anything. (4)

Q59 Changes in sleep pattern

- I have not experienced any change in my sleeping pattern. (1)
- I sleep somewhat more than usual. (2)
- I sleep somewhat less than usual. (3)
- I sleep a lot more than usual. (4)
- I sleep a lot less than usual. (5)
- I sleep most of the day. (6)
- I wake up 1-2 hours early and can't get back to sleep. (7)

Q60 Irritability

- I am no more irritable than usual. (1)
- I am more irritable than usual. (2)
- I am much more irritable than usual. (3)
- I am irritable all the time. (4)

Q61 Changes in appetite

- I have not experiened any change in my appetite (1)
- My appetite is somewhat less than usual. (2)
- My appetite is somewhat greater than usual. (3)
- My appetite is much less than before. (4)
- My appetite is much greater than before. (5)
- I have no appetite at all. (6)

- I crave food all the time. (7)

Q62 Concentration difficulty

- I can concentrate as well as ever. (1)
- I can't concentrate as well as usual. (2)
- It's hard to keep my mind on anything for very long. (3)
- I find I can't concentrate on anything. (4)

Q63 Tiredness or Fatique

- I am no more tired or fatigued than usual. (1)
- I get more tired or fatigued more easily than usual. (2)
- I am too tired or fatigued to do a lot of the things I used to do. (3)
- I am too tired or fatigued to do most of the things I used to do. (4)

Q64 Loss of Interest in Sex

- I have not noticed any recent change in my interest in sex. (1)
- I am less interested in sex than I use to be. (2)
- I am much less interested in sex now. (3)
- I have lost interest in sex completely. (4)

Appendix D

Depressive symptoms regarding loss of energy, sleep pattern and concentration before COVID-19

Q65 The next questions relate to how you have been feeling **before the pandemic** started.

Q66 Before the pandemic, my loss of energy

- ○ Was as much as ever. (1)
- ○ I had less energy than I used to have. (2)
- ○ I didn't have enough energy to do very much. (3)
- ○ I didn't have enough energy to do anything. (4)

Q67 Before the pandemic, my concentration ability

- ○ I could concentrate as well as ever. (1)
- ○ I couldn't concentrate as well as usual. (2)
- ○ It was hard to keep my mind on anything for very long. (3)
- ○ I found I couldn't concentrate on anything. (4)

Q68 Before the pandemic, my sleeping pattern

- ○ I did not experience any change in my sleeping pattern. (1)
- ○ I slept somewhat more than usual. (2)
- ○ I slept a lot more than usual. (3)
- ○ I slept a lot less than usual. (4)
- ○ I slept most of the day. (5)
- ○ I woke up every 1-2 hours early and can't get back to sleep. (6)

Appendix E

QQ plot normality total score Beck Depression Inventory II