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The Mediating Role of Rumination in the Relationship between Loneliness and Depression in University Students during the COVID-19 Pandemic

Ines Luttenbacher [1,2,*], Jamie S. Breukel [1] and Maheen M. Adamson [2,3]

[1] Department of Psychology, University of Amsterdam, 1012 WX Amsterdam, The Netherlands; jamiebreukel@gmail.com
[2] Adamson Lab, Headache Center for Excellence, Rehabilitation Service, VA Palo Alto Health Care System, 3801 Miranda Avenue, Palo Alto, CA 94304, USA; madamson@stanford.edu
[3] Department of Neurosurgery, Stanford University School of Medicine, 300 Pasteur Drive, Palo Alto, CA 94304, USA
* Correspondence: ines.luttenbacher@gmail.com

Abstract: Introduction: While mitigation procedures are needed to prevent the continuous spread of COVID-19, they may, in turn, negatively impact individuals' mental health. Therefore, the current study aimed to investigate the relationships between loneliness, rumination, and depression, as well as the mediating role of rumination in the relationship between loneliness and depression in university students during the COVID-19 pandemic. Methods: A cross-sectional online survey was circulated, collecting a final sample of 288 university students (M_{age} = 22.01, *SD* = 3.45, range = 18–55, 75.7% female). Study variables were measured utilizing self-report questionnaires. Results: In line with the hypotheses, rumination partially mediated the relationship between loneliness and depression. Discussion: Therefore, ruminative thoughts may be one of the key factors contributing to lonely university students' susceptibility to depressive symptoms during the COVID-19 pandemic.

Keywords: rumination; loneliness; depression; mental health; COVID-19 pandemic; coronavirus; university students

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1. Introduction

Unprecedented, the current COVID-19 pandemic has revealed itself to be one of the most devastating and deadliest health crises in recent history. More than a year following the outbreak of the novel Coronavirus (SARS-CoV-2), approximately 175 million people have already contracted the disease and more than 3.8 million deaths have been reported [1]. Governments worldwide were forced to implement several mitigation procedures, including social distancing, isolation, and quarantine [2]. While these measures are needed to prevent the continuous spread of COVID-19, they contrast with the basic human need for social connection and may, therefore, contribute to the development of mental health problems.

Indeed, several early studies have revealed that COVID-19 not only directly affects people's physical health, but that it may also have indirect, detrimental effects on their psychological well-being. For instance, an increase in depression [3–6] and feelings of loneliness [5] as a result of social isolation [4,7], has recently been reported.

Early theorists have established loneliness as an antecedent of depression. In line with other scholars, depression is defined as experiencing a low mood among other symptoms, such as feelings of worthlessness and hopelessness [8]. Loneliness can be defined as a negative emotional response to suboptimal relationships resulting from a discrepancy between one's desired and achieved quality of social relationships [9]. Some authors have suggested that loneliness threatens an individual's self-concept and self-worth when the self is predominately defined in terms of their suboptimal social relationships [9,10]. This,

in turn, could leave such individuals more vulnerable to depression [9–11]. A recent meta-analysis supported this theory by showing that loneliness strongly predicts depression [12]; a finding that was further supported by studies conducted during the COVID-19 pandemic [13,14].

University students are thought to be particularly affected by the social isolation rules following the outbreak of COVID-19 [15]. Preceding COVID-19, attending university was already a stressful period in terms of maintaining the quality of social relationships and, subsequently, adjusting socially and emotionally [16]. With social isolation rules and online education now being implemented, the maintenance of such quality social relations may become more strenuous and trigger negative health consequences. Indeed, during the COVID-19 pandemic, 82% of a sample consisting of Bangladeshi university students reported mild to severe depressive symptoms in response to COVID-19-related social isolation [17]. This elucidates an increase in the prevalence of depression prior to COVID-19 [18]. Notably, a strong link between loneliness, depression, and suicide in college students has been identified [19], further illustrating the importance of investigating the relationship between loneliness and depression by elucidating its contributing factors.

From a theoretical perspective, rumination may explain the relationship between loneliness and depression. Rumination can be defined as a discrepancy-based, maladaptive coping strategy, as individuals often start ruminating when experiencing a discrepancy between their desired and achieved situations [20–22]. As mentioned, loneliness may arise from the discrepancy between one's desired and achieved quality of their social relationships [9,23]. Therefore, feelings of loneliness may evoke a maladaptive coping strategy, such as rumination. Within the context of the COVID-19 pandemic, not being able to control and change the experienced discrepancy between one's desired and achieved quality of social relationships might exacerbate rumination. Rumination, in turn, may cause people to remain fixated on negative experiences, such as those imposed by the COVID-19 pandemic, and can, in turn, impair problem solving [21,24]. According to the response styles theory, this fixation on negative experiences and the subsequent inability to diverge from a negative state of mind may give rise to depressive symptoms [21,24,25]. In summary, individuals experiencing loneliness during the COVID-19 pandemic may be more likely to engage in a maladaptive coping strategy, such as rumination which, in turn, may increase their risk of experiencing depressive symptoms.

Research preceding COVID-19 has already established rumination as a partial mediator in the relationship between university students' loneliness and depression [26]. Research during COVID-19 has also identified that rumination plays a partially mediating role in the relationship between COVID-19 stressors and stress consequences for university students [27]. The authors of these studies used scales for COVID-19 stressors and stress consequences that included items for loneliness and depression, respectively. As such, their results may be indicative of what the current study might find.

Although prior research has already found that rumination mediates the relationship between loneliness and depression in university students, whether this finding holds during a global pandemic has, heretofore, remained unclear. Therefore, the current study aims to expand existing knowledge of the aforementioned mediation model, by investigating the relationships between loneliness, rumination, and depression in a diverse sample of university students during the ongoing COVID-19 pandemic; a time characterized by increased, and forced, social isolation and, historically unique, circumstances of widespread online education. Investigating the factors contributing to depression is of the utmost importance, as findings may improve clinical practice and patient care by highlighting the most important issues requiring attention in attempts to effect change during a global pandemic. This, in turn, could allow for more targeted interventions that may help in the battle against mental health challenges that university students may face post-COVID-19.

Based on the theoretical framework and prior research presented here, five hypotheses were formed (Figure 1). The first hypothesis assumes that loneliness predicts depression (path c). Secondly, loneliness is hypothesized to predict rumination (path a), followed

by the third hypothesis assuming rumination to predict depression (path b). Fourth, it is hypothesized that loneliness predicts depression if controlled for rumination indicating a partial mediation (path c′). Lastly, the fifth hypothesis assumes that rumination mediates the relationship between loneliness and depression (path a*b). The purpose of this paper was to investigate the relationships between loneliness, rumination, and depression with the intention of ultimately providing a mediation model in which loneliness serves as the predictor, rumination as the mediator, and depression as the outcome.

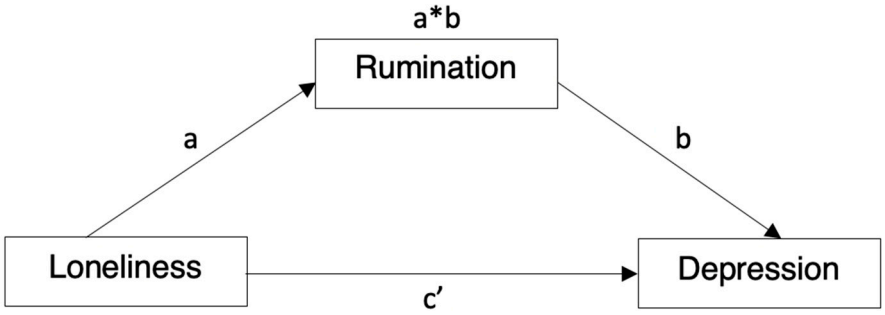

Figure 1. The hypothesized mediation model illustrating the predictive paths between loneliness, rumination, and depression. Loneliness predicts depression (path c); loneliness predicts rumination (path a); rumination predicts depression (path b); loneliness predicts depression if controlled for rumination, indicating a partial mediation (c′); and rumination mediates the relationship between loneliness and depression (a*b).

2. Method

2.1. Study Design

An English, cross-sectional, 10- to 15-min electronic survey was circulated through an online platform called Qualtrics (see OSF for link to survey file https://osf.io/nfre9/?view_only=9ca256578fb74d98b979130e7fcb70b4 (accessed on 2 December 2020). For this study, we collected data as part of a larger collaboration, therefore not all of the questionnaires in the survey were utilized. Survey data was collected from 2 December 2020 until 11 December 2020. The study design was strictly correlational since no variables were manipulated.

2.2. Participants

Utilizing a snowballing technique and convenience sampling, participants were recruited via the researchers' social networks, including WhatsApp, LinkedIn, Facebook, Instagram, and the Adamson Brain Stimulation lab. Students from the University of Amsterdam (UvA) had the opportunity to earn 0.5 research credits when participating via the UvA lab. An a priori power analysis ($\alpha = 0.05$, 95% power) showed that we required a sample size of 147 participants to detect medium effects [28]. A total of 410 university students partook in this study. Participants were included in the final analysis if they (a) were enrolled in a university, (b) were at least 18 years of age, (c) received a form of online education due to social isolation rules, and (d) signed the informed consent form. Participants were excluded if they (a) did not complete the entire survey, (b) failed to answer the items correctly, (c) completed the survey in under five minutes, and (d) provided invalid answers for demographics. The number of participants excluded for each criterion is outlined in Appendix A. Upon cleaning the data, a final sample of 288 university students ($M_{age} = 22.01$, $SD = 3.45$, range = 18–55, 75.7% female) was acquired. Table 1 displays an overview of additional demographic categories used in the current study.

Table 1. Demographic Categories (N = 288).

Demographic Categories	Frequency	Valid Percentage
Nationality		
Dutch	121	42
German	50	17.4
Other	117	40.6
Ethnicity		
White	228	79.2
Moroccan/Turkish/North-African	8	2.8
Black	2	0.7
Asian	20	6.9
Hispanic	10	3.5
Other	20	7
Online Education		
Completely	202	70.1
Partially	82	28.5
Other [1]	4	1.4

Note. [1] The Online Education category "Other" consisted of an open-ended question in which participants could state their special circumstances regarding the form of education they received during the COVID-19 pandemic.

3. Materials

Depressive symptoms. Depressive symptoms experienced over the past week were assessed using the Center of Epidemiologic Studies Depression Scale (CES-D) [8]. The CES-D is a 20-item self-report questionnaire consisting of four positively formulated items and 16 negatively formulated items. Each item comprises four possible response options ranging from 0 (rarely or none of the times) to 3 (most or all of the times). Statements included "I felt sad" and "My sleep was restless". By summing up each item's scores, a total score ranging from 0 to 60 can be calculated, with higher scores indicating greater depressive symptomatology. A score of 16 or above indicates presence of depression. Cronbach's α = 0.92 was calculated, suggesting a very good level of the scale's internal consistency [29]. According to Radloff (1977) [8], the test-retest reliability is good, ranging from r = 0.45 to r = 0.7 [30].

Loneliness. Loneliness was measured using the De Jong Gierveld Loneliness scale [31]. The Loneliness scale is an 11-item self-report questionnaire measuring emotional and social loneliness. Five items are formulated positively and six negatively. Participants respond to the items on a 5-point scale (1 = yes!, 2 = yes, 3 = more or less, 4 = no, 5 = no!). Possible items include "I miss having people around me" and "I experience a general sense of emptiness". Following correction, a total score ranging from 0 to 11 can be calculated, with higher scores indicating a more severe sense of loneliness. A score of 3 or above is interpreted as an indicator of loneliness being present. The scale's internal consistency was calculated, with a Cronbach's α = 0.82 indicating a very good level [29]. Test-retest reliability ranges from r = 0.81 to r = 0.85 [32], suggesting excellent test-retest reliability [30].

Rumination. Rumination was assessed using the Perseverative Thinking Questionnaire (PTQ) [33]. The PTQ is a self-report questionnaire consisting of 15 negatively formulated items to which participants respond on a scale ranging from 0 (never) to 4 (almost always). Possible items include "Thoughts intrude into my mind" and "I can't stop dwelling on them". By summing up each item's score, a total score ranging from 0 to 60 can be calculated, with higher scores indicating higher levels of rumination. The internal consistency was calculated with a Cronbach's α = 0.95, indicating a very good reliability level [29]. According to Ehring and colleagues (2011) [33], test-retest reliability is r = 0.69. This is suggestive of a good test-retest reliability [30].

Demographic variables. Age, gender, nationality, ethnicity, and online education were included as demographic variables. To report the psychological factor, as opposed to the biological factor, gender, rather than sex, was quantified.

3.1. Procedure

The current study was approved by the Ethics Review Board (ERB) of the University of Amsterdam (UvA). Consent was obtained from all participating university students. Once consent was given voluntarily, participants anonymously filled out the survey. Participants from the UvA received 0.5 research credits upon finishing the survey. The possibility of receiving a debriefing and contact information was offered, upon survey completion, to participants needing psychological help.

3.2. Statistical Analyses

The software package SPSS Statistics (Version 26.0) was used for all statistical analyses. Unless otherwise specified, an alpha level of 0.05 was used to determine significance for all statistical tests. Preliminary analyses were conducted, starting with the calculation of demographics, Cronbach's α, and intercorrelations. Intercorrelations were calculated to acquire information about whether the variables were related before proceeding with the main analysis. The rumination and loneliness variables were standardized [34], allowing for an accurate comparison between the study variables. Thereafter, the mediation assumptions were tested. Lastly, the hypotheses, including the final mediation model, were tested utilizing PROCESS macro for SPSS (Model 4) (Version 3.5) [35]. In order to test for significance of the indirect effect, bootstrap 95% confidence intervals (CI) using 5000 bootstrap samples were used [35]. Effects were deemed significant if 95% CIs did not include zero.

4. Results

4.1. Preliminary Analyses

Table 2 lists the means and intercorrelations of the study variables. The study variables showed positive intercorrelations, with depression and loneliness being strongly correlated, $r = 0.571$, $p < 0.001$; loneliness and rumination being strongly correlated, $r = 0.690$, $p < 0.001$; and rumination and depression showing a medium correlation, $r = 0.425$, $p < 0.001$. University students reported moderate loneliness ($M = 5.66$, $SD = 3.05$) heightened levels of rumination ($M = 46.67$, $SD = 12.00$), and symptoms of depression ($M = 22.07$, $SD = 11.59$).

Table 2. Univariate Statistics and Intercorrelations of the Study Variables ($N = 288$).

Variables	Mean	SD	1	2	3
1. Depression	22.07	11.59			
2. Loneliness	5.66	3.05	0.571 **		
3. Rumination	46.67	12.00	0.426 **	0.690 **	

Note. Small $r = 0.1$, medium $r = 0.3$, large $r = 0.5$ [36] ** $p < 0.001$.

Mediation assumptions were tested based on prior scholars' suggestions [37,38]. All assumptions were satisfied: (1) Depression was a continuous dependent variable, (2) the relationship between depression and both loneliness and rumination, was linear, (3) the residuals were independent, (4) no influential cases biased the mediation model, (5) residuals were normally distributed, (6) multicollinearity was met, and (7) homoscedasticity was met.

4.2. Mediation Analysis

A mediation analysis using standardized predictors was performed to examine the mediating role of rumination in the relationship between loneliness and depression, by investigating the relationships between those variables in university students during the COVID-19 pandemic (Figure 2).

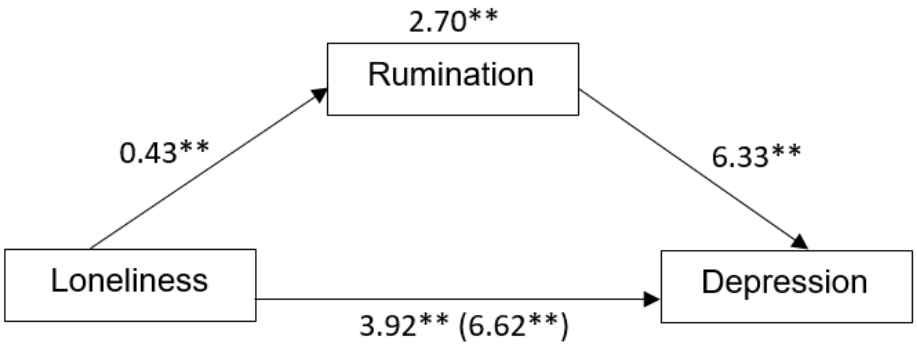

Figure 2. Model of loneliness as a predictor of depression, mediated by rumination with the accompanying unstandardized regression coefficients of each path (N = 288). Number in parentheses denotes path c. ** $p < 0.001$.

Hypothesis one stated that loneliness predicts depression. Hypothesis one was supported as there was a significant total effect of the loneliness score on the depression score (path c), $b = 6.62$, $t(286) = 11.76$, $p < 0.001$. On average, higher scores on the loneliness scale predicted higher scores on the depression scale.

Hypothesis two stated that loneliness predicts rumination. Results showed that the loneliness score significantly predicted the rumination score (path a), $b = 0.43$, $t(286) = 7.97$, $p < 0.001$. On average, higher scores on the loneliness scale predicted higher scores on the rumination scale. Therefore, hypothesis two was supported.

Hypothesis three stated that rumination predicts depression. This was supported as the rumination score significantly predicted the depression score (path b), $b = 6.33$, $t(286) = 12.73$, $p < 0.001$. On average, higher scores on the rumination scale predicted higher scores on the depression scale.

Hypothesis four stated that loneliness predicts depression if controlled for rumination. Results showed a significant direct effect of the loneliness score on the depression score if controlled for the rumination score (path c′), $b = 3.92$, $t(286) = 7.88$, $p < 0.001$, accounting for a partial mediation. On average, higher scores on the loneliness scale predicted higher scores on the depression scale if rumination remained constant. Therefore, hypothesis four was supported.

Hypothesis five stated that rumination mediates the relationship between loneliness and depression. This was supported as there was a significant indirect effect of the loneliness score on the depression score through the rumination score (path a*b), $b = 2.70$, $SE = 0.40$, 95% BCa CI [1.93, 3.51]. On average, higher scores on the loneliness scale predicted higher scores on the depression scale, which was explained by higher scores on the rumination scale. The mediation effect accounted for 40.76% of the total effect of loneliness on depression.

4.3. Exploratory Analysis

An exploratory analysis extending the mediation model by including gender, nationality, ethnicity and online education as covariates was performed. Results show no effects of the covariates on the mediation analysis. Table 3 shows the results of the mediation analysis including covariates. Hypothesis one was still supported showing that, on average, higher scores on the loneliness scale significantly predicted higher scores on the depression scale (path c), $b = 6.56$, $t(282) = 11.63$, $p < 0.001$. Hypothesis two was still supported as, on average, higher scores on the loneliness scale significantly predicted higher scores on the rumination scale (path a), $b = 0.41$, $t(282) = 7.82$, $p < 0.001$. Hypothesis three was still supported as results indicated that, on average, higher scores on the rumination scale significantly predicted higher scores on the depression scale (path b), $b = 6.43$, $t(281) = 12.42$, $p < 0.001$. Hypothesis four was supported as there was still a significant direct effect of the loneliness score on the depression score if controlled for the rumination score (path c′), $b = 3.93$, $t(281) = 7.85$, $p < 0.001$, accounting for a partial mediation. On average, higher

scores on the loneliness scale predicted higher scores on the depression scale if rumination remained constant.

Table 3. Results of Mediation Analysis Including Covariates (N = 288).

Path	*b*	*t*	*p*	95% C.I.	
				Lower	Upper
c	6.56	11.63	<0.001		
a	0.41	7.82	<0.001		
b	6.43	12.42	<0.001		
c′	3.93	7.85	<0.001		
a*b	2.63			1.87	3.47

Note. Displayed are the unstandardized regression coefficients (*b*), the *t*-values and the *p*-value of each path. The Lower and Upper 95% Confidence Interval (C.I) of the indirect effect (a*b) is displayed.

Importantly, hypothesis five was still supported even after controlling for covariates, as there was a significant indirect effect of the loneliness score on the depression score through the rumination score (path a*b), b = 2.63, SE = 0.41, 95% BCa CI [1.87, 3.47]. Those results indicate that, on average, higher scores on the loneliness scale predicted higher scores on the depression scale, which was explained by higher scores on the rumination scale. The mediation effect accounted for 40.1% of the total effect of loneliness on depression. Therefore, the mediation effect including covariates accounted for 0.66% less of the total effect of loneliness on depression than the mediation effect excluding covariates.

5. Discussion

This study has investigated the mental health of university students during the ongoing COVID-19 pandemic. To this end, the study expanded existing knowledge on the mediating role of rumination in the relationship between loneliness and depression, as well as the relationships between those variables. In line with our hypotheses, it was found that loneliness predicted both depression (1) and rumination (2). Moreover, rumination was found to be a predictor of depression (3). Additionally, the results indicated that loneliness predicted depression even when rumination was controlled for, thus indicating a partial mediation (4). Lastly, rumination mediated the relationship between loneliness and depression (5). Gender, nationality, ethnicity, and online education were included as covariates in an exploratory analysis and did not affect the conclusions drawn.

5.1. Relation to the Theoretical Framework

These findings align with the proposed theoretical framework [9,21,23–25]. Importantly, since the current study utilized a correlational design, it does not allow for causal inferences about the directionality of effects proposed by the theoretical framework. For instance, despite early theorists and a meta-analysis suggesting loneliness as the antecedent of depression [9,11,12,23], loneliness may also be bidirectional [39]: (1) Loneliness threatens an individual's self-concept and self-worth, making them more vulnerable to depression [9–11,23], (2) Depression then causes interpersonal problems and subsequent damage to relationships which, in turn, induces more loneliness [40]. Hence, a vicious cycle between loneliness and depression may perpetuate the symptoms of both. Collectively, future research should investigate the possibility of bidirectionality and its effects on the mediating role of rumination using longitudinal data, once available.

5.2. Relation to Prior Research

As expected, the findings of the current study further support prior research by Vanhalst and colleagues (2012) [26]. Since both the study design and targeted population were comparable to the current study, similar conclusions were drawn regarding rumination being a partial mediator. The present study found that, as a partial mediator, heightened

rumination only explained 40.76% of the total effect of loneliness on depression. This suggests that other mediators or moderators might play a role in accounting for this effect. In contrast to Vanhalst and colleagues (2012) [26] and the current study, Zawadzki and colleagues (2013) [41] investigated trait anxiety as an additional mediator alongside rumination. In doing so, they identified a full mediation as opposed to a partial mediation. As we continue to conduct research during the pandemic, it would be prudent to extend the current mediation model by including extra variables, such as trait anxiety.

The current study was conducted during a global pandemic, thereby providing timely and important findings. The results indicated that, compared to non-pandemic circumstances, university students during the COVID-19 pandemic experienced an increase in loneliness, rumination, and depression [42–44]. The increase in loneliness during the COVID-19 pandemic aligns with prior research showing that social isolation acts as a risk factor for experiencing an increase in feelings of loneliness [5,7]. Concerning rumination, it may be argued that rumination imposed by the COVID-19 pandemic is unique from typical rumination, as it involves more uncertainty and uncontrollability, possibly leading to a heightened fixation on "what if" responses among those affected. As suggested by prior research, an explanation for an increase in depression during the COVID-19 pandemic is the amplified number of stressors imposed, such as limited social interactions and increased worrying [3,45]. Since meta-analyses provide more reliable findings, and information about whether means significantly differ, future researchers may benefit from a meta-analytical examination of the mediation model presented here.

6. Limitations

Although the current study revealed important and timely findings, the following limitations should be considered whilst interpreting the results. First, as briefly touched upon previously, the current study did not have access to longitudinal data, thereby limiting inferences drawn about the causality of effect. However, by utilizing a cross-sectional design during a global pandemic, the current study was able to acquire well timed insights, thereby providing an early milestone towards a better understanding of rumination's role in the relationship between loneliness and depression. It is now up to future research to build upon these findings in a follow-up longitudinal study capable of providing more reliable and robust causal conclusions regarding rumination as the primary contributing factor in the relationship between loneliness and depression [46–49].

Second, although convenience sampling was the least time-intensive and expensive method, it may have led to an overrepresentation of certain subgroups [50]. Indeed, the current study's sample was predominately female, possibly limiting the generalizability of the findings to males. Furthermore, it is important to note that even though investigating the current mediation model using university students was imperative, generalizability of the current results to other groups is limited. Future research may benefit from investigating the current mediation model in an older population since, for instance, the physical effects of behavioral choices (e.g., smoking, drinking) on mental health are likely to compound over time, possibly providing additional pathways that predict depressed mood among older adults.

Third, the three self-report questionnaires utilized in the survey were not counterbalanced across participants, possibly leading to an anchoring effect and, subsequently, inflated correlations. However, correlations found in the current study are in line with prior research [41]. Therefore, it was concluded that the results of the current study were not significantly influenced by the anchoring effect. Nevertheless, even though self-report questionnaires were the most appropriate means of measuring subjective and internal processes, future research should employ counterbalanced questionnaires.

7. Conclusions

Notwithstanding these limitations, the present study provided important findings by showing that ruminative thoughts are an imperative factor towards understanding the key

factors that contribute to lonely university student's greater susceptibility to depressive symptoms during the COVID-19 pandemic. Furthermore, by illustrating that loneliness predicted both rumination and depression in this study, the cumulative negative effects of loneliness on mental health became apparent. Since loneliness remained a predictor of depression even when rumination was controlled for, counselling for university students may benefit from targeting loneliness in addition to rumination. Collectively, each of the paths outlined in the mediation model was noteworthy and should be considered by health authorities, as intervention and prevention programs at multiple stages might be necessary to manage university students' mental health. In conclusion, to avoid the negative long-term mental health consequences observed in previous pandemics [51], (Brooks et al., 2020), health counsellors should utilize the current study's insights to help university students improve their psychological well-being during the ongoing COVID-19 pandemic.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

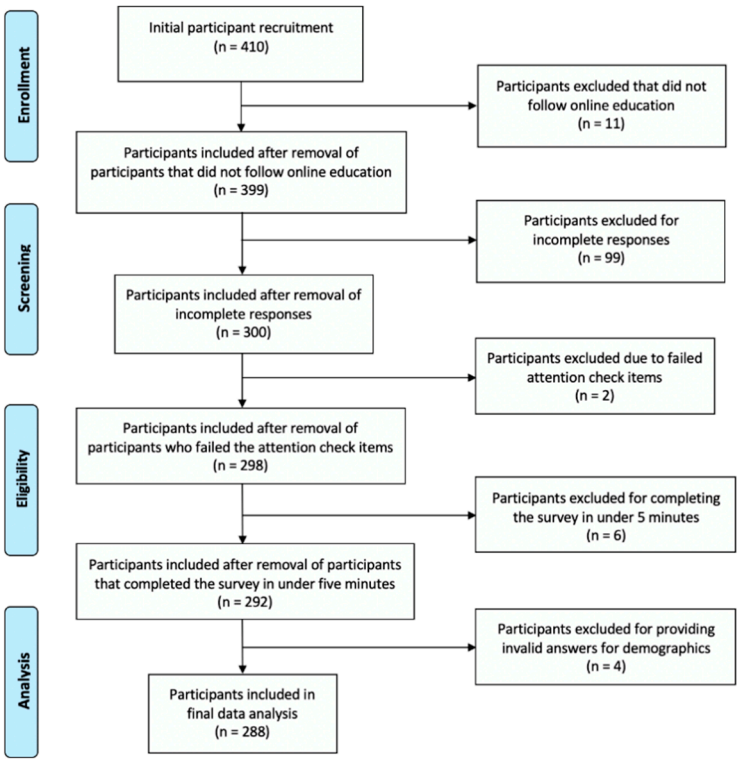

Figure A1. Participant Flowchart displaying participants excluded for each exclusion criteria specified.

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