The more mindfulness practice, the more post-trauma stress symptoms? Trait mindfulness and PTSS during the COVID-19 pandemic

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Abstract

Investigating the contributing factors of post-traumatic stress symptoms (PTSS) has always been an important topic in the field of traumatic psychology research. The current study explored the influences of pandemic/epidemic experiences, meditation experiences, and trait mindfulness on PTSS and the mediating role of emotional resilience during the COVID-19 pandemic. A total of 522 participants in Hubei province completed the Five Facet Mindfulness Questionnaire, the Adolescents' Emotional Resilience Questionnaire, and the PTSD Checklist for DSM-5. The results showed that (1) participants who had family or friends diagnosed with COVID-19 scored higher on avoidance. (2) Participants who had family or friends had been diagnosed with SARS or H1N1 scored higher on PTSS. (3) Participants with meditation experience scored significantly higher on all dimensions of PTSS, other than avoidance. (4) The mediating role of recovering from negative emotions in the relationship between trait mindfulness and PTSS was significant (95%CI= [-0.212, -0.094]), while the generating positive emotion was not significant (95%CI= [-0.050, 0.071]). Individuals with pandemic/epidemic experience are more likely to have a high level of PTSS. Individuals who have meditation experience also express a higher level of PTSS, which may be a result of the quality of meditation. Trait mindfulness and the ability to recover from negative emotions were protective factors against PTSS.

Keywords Trait mindfulness · Emotional resilience · Post-traumatic stress symptoms · Meditation experiences

Coronavirus disease (COVID-19) is one of the greatest global public health threats in the 21st century. While controlling the pandemic and caring for sick patients are the main focus globally, mental health problems caused by the COVID-19 outbreak are also of critical importance.

Many researchers focused on post-traumatic stress disorder (PTSD) in the epidemic (d' Ettorre et al., 2021; Di Tella et al., 2020). Researchers have reported that the prevalence of post-trauma stress symptoms (PTSS) was 7% one month after the outbreak of COVID-19 in Hubei province, China (Liu et al., 2020). PTSD is a delayed and persistent psychological disorder caused by stress, fear, or traumatic events (Bai & Li, 2015). According to the definition in the DSM-5, the core symptoms of PTSD include persistent intrusion symptoms, avoidance symptoms, negative alterations in cognition or mood symptoms, and changes in arousal, which are related to experienced traumatic events (American Psychiatric Association, 2013). While most health problems will gradually dissipate after the pandemic has ended, PTSS may continue for a long period of time and put individuals at risk. Therefore, it is critical to explore risk and protective factors of PTSS.

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Mindfulness and PTSS

In recent years, a large number of studies have focused on the role of mindfulness in mental health and post-traumatic stress (e.g., Chen et al., 2019; Hopwood & Schutte, 2017; Wen et al., 2021). Trait mindfulness refers to the ability to be aware of present experiences in an open and non-judgmental manner (Kabat-Zinn, 2011). According to Vujanovic's indirect mechanism of emotional cognitive exposure of mindfulness (2011), mindful individuals may have the ability to focus on both positive and negative thoughts and emotions as they arise and to tolerate distressing internal experiences by observing their transient nature. Therefore, mindfulness may help in the management of trauma-related internal and external cues in an approach-oriented way and reduce experience avoidance, thus alleviating PTSS. Many studies have reported that trait mindfulness is negatively correlated with PTSS (Chen et al., 2019; Reffi et al., 2019; Wen et al., 2021) and a meta-analysis found that mindfulness-based interventions can reduce PTSS (Hopwood & Schutte, 2017). Therefore, mindfulness may help alleviate PTSS caused by COVID-19.

Previous studies have reported that physical and mental health are improved after standard group mindfulness training (Gál et al., 2020). Unlike traditional face-to-face mindfulness intervention, smart mobile phone applications and web-based platforms can provide new avenues for autonomous mindfulness exercises. A growing number of studies have shown that digital mindfulness-based interventions (d-MBIs) can improve attention, and decrease stress, depression, and anxiety (e.g., Mrazek et al., 2018). However, there are a variety of challenges associated with d-MBIs, including poor learning and difficulty to solve problems in the autonomous practice process. Therefore, the effectiveness of d-MBIs may be inhibited (Mrazek et al., 2018). During the COVID-19 pandemic period, in order to avoid infection due to face-to-face practice, mindfulness practice has more often been practiced autonomously. Therefore, the current study hypothesized that participants with meditation experience would hold more positive attitudes about the pandemic and score lower on PTSS.

Emotional Resilience and PTSS

In addition, the mechanism between trait mindfulness and PTSS is worth exploring. Emotions play critical roles in PTSS, and the dual representation theory postulates that PTSS is affected by emotional processing in response to traumatic events (Brewin et al., 1996). Negative emotions can cause increased attentional bias toward stressful events, inducing feelings of helplessness, which in turn, may lead to more negative emotions and stress (Garland et al., 2010). This cycle generates a downward spiral that can ultimately result in serious mental illnesses (Garland et al., 2010). Moreover, negative emotions (e.g., anxiety or fear) can affect the autonomic nervous system, increasing arousal and raising blood pressure, which may consequently affect attention and behaviors (Galatzer-Levy et al., 2013). On the other hand, positive emotions have been associated with healthy psychological outcomes (Fredricksonc et al., 2003). For example, positive emotions can mitigate and eliminate the negative effects of stressful events (Fredricksonc et al., 2003). Thus, the management of positive and negative emotions after trauma may be the key factors for the relief of PTSS.

Emotional resilience has been proposed by researchers in the field of resilience, which refers to the ability to generate positive emotions (GP) and recover from negative emotions (RN) in the face of stressful situations (Davidson, 2000). Emotional resilience is an effective psychological coping strategy to deal with the ups and downs of life, which was negatively associated negative emotions (Pandey et al., 2021). Individuals with a high level of resilience exhibited stable mental health functioning after traumatic events (Li et al., 2020a, b; Wang et al., 2016a, b). Resilience interventions can effectively promote personal growth associated with stressful events in college students (Dolbier et al., 2010). A low level of emotional resilience is a risk factor for mood disorders, often leading to anxiety, depression, or other psychological problems (Li et al., 2020a, b; Wang et al., 2016a, b). In accordance with the above research, high levels of emotional resilience may be associated with a decrease in PTSS.

Mindfulness and Emotional Resilience

Prior research has noted a link between trait mindfulness and emotions. Mindfulness is characterized by decentering, where the individual can separate from the content of consciousness and observe his/her own experience each moment from a more objective and clear perspective (Shapiro et al., 2010). A mindful state leads to a more flexible and wider scope of attention, which enables positive reappraisal of stressful events and ultimately more positive emotions. Although positive emotions are transient, they can lead to increases in personal resources and create an upward spiral (Garland et al., 2010). A high level of mindfulness has been associated with more positive emotions in both clinical and non-clinical groups (Du et al., 2019; McLaughlin et al., 2019). Researchers have found that positive emotions deepen after an increase in trait mindfulness in ecological momentary assessment study, providing temporal evidence

for a causal relationship (Keng & Tong, 2016). In addition, individuals with a higher level of mindfulness demonstrate faster heart rate recovery to baseline levels after experiencing negative emotions (Fogarty et al., 2013) and although they experience the same degree of negative emotions in response to negative stimuli, they return to emotional baseline more quickly (Cho et al., 2016). Both brief mindfulness intervention and six weeks of mindfulness training have been proved to be beneficial to recovery from negative emotions (Crosswell et al., 2017; Keng et al., 2011). Researchers also found that trait mindfulness were associated with emotions through the two dimensions of emotional resilience (Wang et al., 2016a, b), and mindfulness-based interventions promoted emotional resilience in at-risk youth (Culang et al., 2021). Therefore, mindfulness is likely to improve the ability to generate positive emotions and to recover from negative emotions and may alleviate PTSS through two dimensions of emotional resilience (GP and RN).

Study Aims

The current study explored the effects of trait mindfulness on PTSS and the mediating role of emotional resilience during the COVID-19 pandemic. However, Prior studies suggested that prior and present traumatic experience were risk factors for PTSS (Castelli et al., 2020; Maes et al., 2001). Individuals who have experienced or witnessed the pain associated with COVID-19 or have similar experiences with illnesses (for example, family members or friends were infected with SARS or H1N1) may feel particularly traumatized. Also, different meditation experiences may influence the level of mindfulness and PTSS. Taking together the above arguments and evidence, we hypothesized the following: (a) Participants with pandemic/epidemic experience would hold more negative attitudes about the pandemic and would score higher on PTSS than those without experience; (b) Participants with meditation experience would hold more positive attitudes about the pandemic and score lower on PTSS than those without meditation experience; (c) When controlling the pandemic/epidemic experiences and meditation experiences, the ability to generate positive emotions would be a significant mediating factor in the relationship between trait mindfulness and PTSS; (d) The ability to recover from negative emotions would be a significant mediating factor in the relationship between trait mindfulness and PTSS.

Methods

Participants and Procedure

During the remission period from May 20, 2020 to June 20, 2020, electronic questionnaires were distributed in Hubei

Province, China through the www.wjx.cn, a professional online platform for data collection questionnaire survey. Many researchers used this platform to collect data (Li et al., 2020a, b; Wang et al., 2016a, b). The researcher explained the purpose and significance of the study and the matters needing attention to the participants, so as to obtain the cooperation of them. The completion time of the questionnaire was about 15 min. All study procedures were approved by the ethics committee of the author's institution. A total of 525 questionnaires were collected. After a lie test screening, there were 522 valid questionnaires (54% women; $M_{age} = 29.28$, $SD = 7.83$; $M_{education\ years} = 15.11$, $SD = 2.20$) for analysis. Demographic characteristics are detailed in Table 1.

Measures

The Demographic Variables Questionnaire

Participant demographic data were collected on personal basic information (age, gender, years of education, and marital status), pandemic experience, and mindfulness meditation experience.

The Epidemiological Experience Questionnaire Pandemic and epidemic experience was assessed by a questionnaire including six items: "Have you been infected with COVID-19 / SARS or H1N1?", "Have any of your family, friends or colleagues been diagnosed with COVID-19 / SARS or H1N1?", "Have any of your friends, family, or colleagues died from COVID-19 / SARS or H1N1?"

The Meditation Experience Questionnaire Meditation experience was assessed with three items: "Have you ever been introduced to meditation?", "How many years have you known about meditation?", and "How many minutes/day have you practiced meditation during the last month?"

The COVID-19 Attitude Questionnaire Attitudes about the COVID-19 pandemic were assessed with the following four items: "How high do you think the mortality rate/infection rate of COVID-19 is?", "How likely did you think it is that you will be infected with COVID-19?", and "How much fear do you feel about COVID-19". These items were rated on a 7-point scale (1 = very low; 7 = very high).

PTSD Checklist for DSM-5 (PCL-5)

PTSS was measured by the PCL-5 which includes 20 items rated on a 5-point scale, including four dimensions: intrusion, avoidance, arousal, and negative alterations in cognition or mood symptoms (Weathers, 2013). Higher scores indicate a higher level of PTSS. The scale has been widely used in post-traumatic Chinese populations and has good reliability and validity (Cao et al.,

Table 1 Demographic characteristics of the sample

Gender		Were you infected with SARS or H1N1?	
males	287(55%)	No	520(99.6%)
females	235(45%)	Yes	2(0.4%)
Age	29.28(7.83) (11–58)	Were any of your family, friends or colleagues diagnosed with SARS or H1N1?	
Mean (SD)(Range)		No	469(89.8%)
Education	15.11(2.20) (3–24)	Yes	53(10.2%)
Mean (SD)(Range)		-Diagnosed and deceased	6(1.1%)
Marital status		-Diagnosed and cured	47(89.8%)
unmarried	279(53.4%)	Do you have meditation experience?	
married	231(44.3%)	No	331(63.4%)
divorce	11(2.1%)	Yes	191(36.6%)
widowed	1(0.2%)	-Mean (SD)(Range)(years)	5.32(4.78) (1–31)
Were you infected with COVID-19?		-Practice time (minutes) Mean (SD)(Range)	53.55(34.9) (0-150)
No	522(100%)		
Yes	0(0%)		
Were any of your family, friends or colleagues diagnosed with COVID-19?			
No	440(83.4%)		
Yes	82(15.7%)		
-Diagnosed and deceased	10(12.195%)		
-Diagnosed and cured	72(87.805%)		

2015; Liu et al., 2016). The Cronbach's α for the total scale was 0.900. The Cronbach's α coefficient of the four dimensions were 0.808, 0.793, 0.757, and 0.741 (intrusion, avoidance, arousal, and negative alterations in cognition or mood, respectively).

Five Facet Mindfulness Questionnaire (FFMQ)

A Chinese version of the FFMQ, revised by Deng et al., (2011), was used to study mindfulness. The questionnaire included 39 items divided among five dimensions: observing, describing, acting with awareness, non-judging, and non-reacting. Each item was rated on a 5-point scale (1 = never or very rarely true; 5 = very often or always true). Higher scores on the FFMQ indicate a higher level of mindfulness. The scale was widely used in multiple populations (Carpenter et al., 2019). The internal consistency coefficient and test-retest reliability of the scale were adequate in Chinese samples (Deng et al., 2011). The Cronbach's α for the total scale was 0.817 in the current study. The Cronbach's α coefficient of the five dimensions were 0.767, 0.839, 0.865, 0.688, and 0.517 (observing, describing, acting with awareness, non-judging, and non-reacting, respectively).

The Adolescents' Emotional Resilience Questionnaire (AERQ)

Resilience was measured by the AERQ which contains 11 items measuring the abilities of generating positive emotions

(GP) and recovering from negative emotions (RN) (Zhang & Lu, 2011). The items are rated on a 6-point scale (1 = never true; 6 = always true) with higher scores indicating higher levels of emotional resilience. The scale has also been widely used in adults and has good reliability and validity (e.g., Wang et al., 2016a, b). The Cronbach's α of the total scale was 0.865. The Cronbach's α coefficient of the two dimensions were 0.787 (GP) and 0.809 (RN).

Date Analysis

First, descriptive statistical analyses, correlation analyses, and difference analyses were performed through SPSS 26.0. Then, according to Preacher and Hayes's Mplus syntax (2008), the two mediators was analyzed using Mplus 7.4 (Muthén & Muthén, 2017). Trait mindfulness was put into the analysis as independent variable, GP and RN were mediators at same time, and PTSS was dependent variable.

Common Method Bias Analysis

Harman's single-factor test was applied to examine common method bias (Podsakoff et al., 2003) for exploratory factor analysis of all items. The results showed that there were 21 factors with eigenvalue greater than 1, and that the largest variance of any one factor was 18.22%, which was less than the critical standard of 40.0%, indicating that there was no significant common method bias.

Results

COVID-19 Attitudes and PTSS Among Individuals with Different Pandemic/epidemic Experiences

Descriptive statistical analyses showed that participants had a medium to high level (4.17 ± 1.56) of fear of the pandemic situation, and believed that the mortality rate of COVID-19 was medium to high (4.15 ± 1.48), that the infection rate was high (6.24 ± 0.97), and that the possibility of being infected was low to medium (3.07 ± 1.36). An independent sample t test (see Table 2) showed that participants who reported that they had family or friends who were diagnosed with COVID-19, SARS, or H1N1, thought they were more likely to be infected with COVID-19 ($t_{\text{COVID}-19} = 3.925$, $df = 520$, $p < 0.001$; $t_{\text{SARS or H1N1}} = 2.569$, $df = 520$, $p < 0.01$) compared to those who did not have family or friends diagnosed with the diseases. However, these groups did not differ in their beliefs about mortality rate, infection rate, or in their level of fear.

For symptoms of PTSS (see Table 2), independent sample t tests showed that participants whose family or friends were diagnosed with COVID-19 had a higher level of avoidance symptoms than those whose family or friends had not been diagnosed ($t = 2.799$, $df = 520$, $p < 0.01$). Participants whose family or friends were diagnosed with SARS or H1N1 had a higher level of all PTSS dimensions and total score than those whose family or friends had not been diagnosed ($t_{\text{intrusion}} = 3.583$, $p < 0.001$; $t_{\text{avoidance}} = 2.277$, $df = 520$, $p < 0.05$; $t_{\text{arousal}} = 2.594$, $df = 520$, $p < 0.01$; $t_{\text{negative cognition and mood}} = 0.580$, $df = 520$, $p < 0.01$; $t_{\text{total score}} = 0.307$, $df = 520$, $p < 0.001$).

Effects of Gender and Meditation Experience

Males scored significantly higher than females in both dimensions of emotional resilience and in total resilience ($t_{\text{GP}} = -2.323$, $df = 520$, $p < 0.05$; $t_{\text{RN}} = -3.711$, $df = 520$, $p < 0.001$; $t_{\text{total score}} = -3.438$, $df = 520$, $p < 0.001$). Females believed that the mortality rate and possibility of being infected themselves was significantly higher than what males believed, and also reported a greater degree of fear compared to males ($t_{\text{mortality rate}} = 2.749$, $df = 520$, $p < 0.001$; $t_{\text{being infected}} = 2.954$, $df = 520$, $p < 0.01$; $t_{\text{fear}} = 3.248$, $df = 520$, $p < 0.01$). There were no significant differences between males and females on total scores or dimensions of trait mindfulness or PTSS or on beliefs about infectious rate of the disease (Table 3).

Participants with meditation experience scored significantly higher on observing and non-reacting compared to those without meditation experience ($t_{\text{observing}} = 4.224$, $df = 520$, $p < 0.001$; $t_{\text{no-reacting}} = 2.122$, $df = 520$, $p < 0.05$). However, participants with meditation experience scored significantly lower on the non-judgmental dimension than those without meditation experience ($t = -2.944$, $df = 520$, $p < 0.01$). There were no significant differences on other dimensions or total scores on the FFMQ. With the exception of avoidance, there were significant differences in all dimensions and total score on the PCL-5 between participants with meditation experience and those without ($t_{\text{intrusion}} = 3.257$, $df = 520$, $p < 0.001$; $t_{\text{arousal}} = 3.100$, $df = 520$, $p < 0.01$; $t_{\text{negative cognition and mood}} = 2.571$, $df = 520$, $p < 0.01$; $t_{\text{total score}} = 3.181$, $df = 520$, $p < 0.01$). Finally, individuals with meditation experience reported a higher degree of fear about the pandemic and believed that the mortality rate, and the possibility of being infected themselves was greater than those

Table 2 Analysis of differences in attitudes and PTSS among individuals experiencing different epidemics (n=522)

Variables	Were any of your family, friends or colleagues diagnosed with COVID-19?			Were any of your family, friends or colleagues diagnosed with SARS or H1N1?		
	Yes	No	t	Yes	No	t
Attitude towards the epidemic						
Mortality rate	4.02(1.41)	4.17(1.49)	-0.810	3.91(1.47)	4.17(1.47)	-1.252
Infection rate	6.34(0.82)	6.22(1.00)	1.054	6.43(0.69)	6.22(1.00)	1.554
Possibility of being infected	3.61(1.36)	2.98(1.34)	**3.925*****	3.53(1.40)	3.02(1.35)	**2.569****
Fear level	4.18(1.70)	4.17(1.53)	0.079	4.09(1.61)	4.18(1.55)	-0.376
PTSS						
Intrusion	5.95(4.31)	5.16(3.70)	1.738	7.04(4.39)	5.08(3.69)	**3.583*****
Avoidance	2.63(2.07)	1.98(1.91)	**2.799****	2.66(1.97)	2.02(1.94)	**2.277***
Arousal	8.16(4.72)	7.40(4.84)	1.301	9.21(4.93)	7.39(4.81)	**2.594****
NACM	8.00(5.27)	7.50(4.77)	0.857	9.28(4.87)	7.32(4.78)	**0.580****
Total scores	24.74(13.71)	22.04(12.61)	1.756	28.19(13.46)	21.82(12.59)	**0.307*****

PTSS = post-traumatic stress symptoms; NACM = negative alterations in cognition or mood symptoms; *$p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

The "Bold" means the values of t were significant

Table 3 Analysis of differences in all variables among individuals with different gender and meditation experience (n=522)

Variables	Gender			Meditation experience		
	Females	Males	t	Yes	No	t
Trait mindfulness						
Observing	25.12(5.41)	24.25(5.55)	1.816	25.96(5.29)	23.88(5.48)	**4.224*****
Describing	25.44(5.98)	25.37(5.77)	0.142	25.49(6.15)	25.35(5.69)	0.250
Acting with awareness	27.07(6.63)	27.59(6.28)	-0.906	26.98(6.06)	27.57(6.65)	-0.998
Non-judging	22.48(5.06)	22.86(4.40)	-0.927	21.90(4.67)	23.15(4.67)	**-2.944******
Non-reacting	20.44(3.58)	20.64(3.34)	-0.666	20.97(3.69)	20.31(3.28)	**2.122*****
Total scores	120.56(15.03)	120.71(14.60)	-0.115	121.30(15.22)	120.26(14.53)	0.773
Emotional resilience						
GP	18.86(4.32)	19.76(4.44)	**-2.323*****	19.45(4.53)	19.3(4.34)	0.385
RN	18.52(5.65)	20.31(5.35)	**-3.711*******	19.19(5.52)	19.69(5.57)	-0.982
Total scores	37.38(8.96)	40.07(8.82)	**-3.438*******	38.64(9.01)	38.98(8.96)	-0.418
PTSS						
Intrusion	5.49(3.87)	5.11(3.76)	1.105	5.99(3.98)	4.87(3.65)	**3.257*******
Avoidance	2.07(2.00)	2.09(1.91)	-0.127	2.14(1.96)	2.05(1.95)	0.461
Arousal	7.90(4.89)	7.21(4.75)	1.629	8.38(4.72)	7.03(4.82)	**3.100******
NACM	7.73(5.04)	7.45(4.69)	0.654	8.29(4.80)	7.17(4.84)	**2.571******
Total scores	23.19(12.97)	21.87(12.68)	1.169	24.80(12.70)	21.12(12.71)	**3.181******
Attitude towards the epidemic						
Mortality rate	4.34(1.43)	3.99(1.50)	**2.749******	4.28(1.48)	4.07(1.47)	1.616
Infection rate	6.29(0.97)	6.20(0.97)	1.011	6.38(0.84)	6.16(1.03)	**2.501*****
Possibility of being infected	3.27(1.37)	2.92(1.34)	**2.954******	3.29(1.42)	2.95(1.32)	**2.800******
Fear level	4.41(1.46)	3.97(1.61)	**3.248******	4.39(1.64)	4.04(1.50)	**2.430*****

GP = generate positive emotions; RN = recover from negative emotions; PTSS = post-traumatic stress symptoms; NACM = Negative alterations in cognition or mood symptoms; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

The "Bold" means the values of t were significant

without meditation experience ($t_{\text{mortality rate}} = 2.501$, $df = 520$, $p < 0.05$; $t_{\text{being infected}} = 2.800$, $df = 520$, $p < 0.01$; $t_{\text{fear}} = 2.430$, $df = 520$, $p < 0.05$) (see Table 3).

Descriptive Statistics and Correlation Analyses

Time spent in meditation during the last month was positively associated with observing, non-reacting, total score of trait mindfulness, GP, intrusion, negative alterations in cognition or mood, arousal, and total PTSS score, but negatively associated with non-judging. Trait mindfulness was positively associated with both dimensions and total score on emotional resilience, and negatively associated with negative alterations in cognition or mood symptoms, arousal and total PCL-5 score. The total score of the AERQ was negatively associated with each dimension and total score of the PCL-5 (see Table 4 for details of descriptive statistics and correlation analyses).

Mediating Effects of Emotional Resilience Between Trait Mindfulness and PTSS

When controlling for gender, meditation experience, and pandemic/epidemic experience, trait mindfulness

significantly and negatively predicted PCL-5 score ($\beta = -0.379$, $p < 0.001$). Next, the mediating roles of emotional resilience (GP and RN) were explored. The results showed that (see Fig. 1) trait mindfulness negatively predicted PTSS ($\beta = -0.240$, $p < 0.001$) and positively predicted GP ($\beta = 0.536$, $p < 0.001$) and RN ($\beta = 0.541$, $p < 0.001$). RN significantly and negatively predicted PTSS ($\beta = -0.273$, $p < 0.001$). However, GP had no significant effect on PTSS ($\beta = 0.017$, $p > 0.05$). The mediating role of RN between trait mindfulness and PTSS was significant ($\beta = -0.148$, $p < 0.001$, 95%CI = [-0.212, -0.094]) while there was no mediating effect of GP ($\beta = 0.009$, $p > 0.05$, 95%CI = [-0.050, 0.071]). Analyses of the standard direct, indirect and total effects of trait mindfulness on PTSS are shown in Table 5.

Discussion

The purpose of the current study was to explore the effects of individual pandemic/epidemic experiences, meditation experience, and mindfulness on PTSS and the mediating role of emotional resilience during the COVID-19 pandemic. The

Table 4 The mean (M), standard deviation (SD), and Pearson's correlations of the variables (n = 522)

Variables	M(SD)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Meditation time	20.86(35.89)	1														
2 Observing	24.64(5.50)	0.25**	1													
3 Describing	25.40(5.86)	0.08	0.30***	1												
4 Acting with awareness	27.35(6.44)	−0.04	−0.02	0.48***	1											
5 Non-judging	22.69(4.71)	−0.09*	−0.31***	0.08	0.38***	1										
6 Non-reacting	20.55(3.45)	0.16**	0.31***	0.22***	−0.01	−0.25***	1									
7 FFMQ	120.64(14.78)	0.11**	0.46***	0.80***	0.74***	0.34***	0.36***	1								
8 GP	19.35(4.41)	0.10*	0.24***	0.46***	0.38***	−0.01	0.45***	0.54***	1							
9 RN	19.51(5.55)	−0.00	0.03	0.39***	0.54***	0.25***	0.25***	0.54***	0.62***	1						
10 Emotional resilience	38.86(8.97)	0.05	0.14***	0.46***	0.52***	0.15***	0.38***	0.60***	0.87***	0.92***	1					
11 Intrusion	5.28(3.81)	0.22***	0.23***	−0.12*	−0.34***	−0.24***	0.13**	−0.16***	−0.11*	−0.26***	−0.21***	1				
12 Avoidance	2.08(1.95)	0.08	0.14**	−0.12*	−0.24***	−0.16**	0.11*	−0.13**	−0.07	−0.16***	−0.13**	0.53***	1			
13 Arousal	7.58(4.85)	0.15**	0.09*	−0.32***	−0.50***	−0.28***	0.05	−0.39***	−0.30***	−0.35***	−0.36***	0.57***	0.43***	1		
14 NACM	7.52(4.82)	0.16**	0.09*	−0.30***	−0.56***	−0.29***	0.02	−0.42***	−0.34***	−0.45***	−0.45***	0.57***	0.40***	0.72***	1	
15 PTSS	22.47(12.81)	0.19***	0.16***	−0.29***	−0.54***	−0.31***	0.08	−0.37***	−0.28***	−0.41***	−0.39***	0.81***	0.62***	0.88***	0.88***	1

GP = generating positive emotions; RN = recovering from negative emotions; NACM = Negative alterations in cognition or mood symptoms; $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$
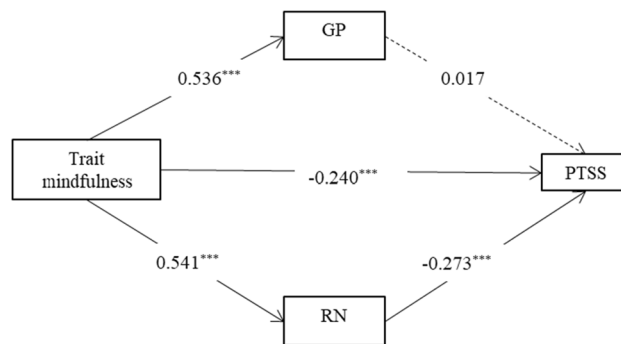
Fig. 1 The mediating role of emotional resilience between trait mindfulness and PTSS. Note: PTSS = post-traumatic stress symptoms; GP = generate positive emotions. RN = recover from negative emotions; $^{***}p < 0.001$

results indicated that participants who had family or friends diagnosed with COVID-19, SARS, or H1N1 developed greater avoidance symptoms and reported a belief that were more likely to be infected with COVID-19 than those who did not have family or friends diagnosed with the diseases. Participants who reported that family or friends had been diagnosed with SARS or H1N1 scored significantly higher on all dimensions and total score of the PCL-5, indicating greater PTSS than those who did not. Participants with meditation experience scored significantly higher than individuals without meditation experience on all PTSS dimensions, except avoidance, and on PTSS total score. In addition, those with meditation experience believed that they were more likely to become infected, that there was a higher rate of infection, and reported experiencing a greater level of fear than those without experience. There was a mediating role of RN, but not GP, in the relationship between trait mindfulness and PTSS.

Differences in Attitudes About COVID-19 and PTSS Among Individuals with Different Pandemic/epidemic Experiences

Participants who had family or friends diagnosed with COVID-19, SARS, or H1N1 believed that the likelihood of

Table 5 Analysis of total, direct and indirect effects of trait mindfulness on PTSS

Variables	Mediators	Effect	SE	95%CI	P
Total effect		−0.139	0.035	[−0.207, −0.071]	< 0.001
Direct effect		−0.240	0.052	[−0.341, −0.139]	< 0.001
Indirect effect	GP	0.009	0.031	[−0.050, 0.071]	0.770
	RN	−0.148	0.029	[−0.212, −0.094]	< 0.001

GP = generating positive emotions; RN = recovering from negative emotions

becoming infected themselves was greater than that reported by those who did not have family or friends diagnosed. However, there was no difference between groups in their estimation of mortality rate, infection rate, or in level of fear. Unlike the other indexes of attitude measured in the current study, the likelihood of becoming infected pertains to oneself and thus participants may have been more sensitive to this belief.

Participants who had family or friends diagnosed with COVID-19 scored higher on the avoidance scale than those who did not have family or friends diagnosed with COVID-19. However, there were no other differences between the groups in symptoms of PTSS. Participants who had family or friends who were infected with SARS or H1N1 scored higher on PTSS subscales and on total PTSS than those without related experiences. These results are consistent with prior studies showing that previous traumatic experience is an important risk factor for PTSS (Gould et al., 2020; Ozer et al., 2003). It is therefore important for clinicians to be particularly vigilant in attending to those who have experienced previous trauma during psychological intervention.

Differences in Variables Between Genders and Participants with Differing Meditation Experience

Males scored significantly higher than females on both dimensions of emotional resilience and total resilience. In addition, female participants estimated a higher mortality rate, infection rate, and reported a greater level of fear of COVID-19 compared to male participants. Prior studies have suggested that females are more emotional and tend to experience, express, and immerse themselves in their emotions (Barrett & Bliss-Moreau, 2009), while males are more proactive, more likely to be solution-focused and to reappraise circumstances in an attempt to control or change emotionally driven situations (Nolen-Hoeksema, 2012). These characteristics may help explain why females were more fearful of the pandemic and why males scored higher on emotional resilience.

Observing and non-reacting were greater in participants with meditation experience compared to those without. However, inconsistent with our hypothesis, participants with no meditation experience scored significantly higher on non-judging than participants with meditation experience. In addition, surprisingly, with the exception of avoidance, participants with meditation experience scored significantly higher on all of the other dimension of PTSS and total PTSS. Furthermore, those with meditation experience believed that are more likely to become infected, estimated higher infection rates, and reported a greater level of fear than those without meditation experience. Moreover, while time spent

in mediation was positively associated with observing, non-reacting, and total scores of mindfulness, it was also positively associated with dimension of PTSS and PTSS total score, but negatively associated with non-judging.

There are a number of possible reasons for these surprising results. First, with an increase in mindfulness practice time, awareness of experiences increases, whether it is positive, negative or neutral (Lindsay & Creswell, 2017). With improvement in awareness, self-observation becomes increasingly objective. Therefore, individuals may observe less negative symptoms in self-report measurements or focus on more negative symptoms that had been ignored or avoided (e.g., PTSS or judgment). In other words, the self-reported PTSS and judgment should more accurately be called "awareness of PTSS" and "awareness of judgment". In addition, the current study was cross-sectional. Therefore, causal conclusions cannot be made. It is possible that participants with greater levels of PTSS may spend more time meditating to relieve symptoms.

The Mediating Role of RN

Consistent with our research hypothesis, participants with a high level of mindfulness more easily recover from negative emotions, leading to alleviation of PTSS. Prior studies have found that PTSS is associated with a high level of negative emotions (Badour et al., 2017; Depierro et al., 2018). Negative emotions often lead to attention bias, ultimately inhibiting the ability to disengage from difficult situations, and thus generating more negative emotions and stress, becoming a vicious cycle (Garland et al., 2010). In fact, mindfulness changes the way in which individuals experience emotions, helping them to observe and accept emotions in a non-judgmental way, rather than directly automating responses. This process is a transition from "auto navigation mode" to "being mode" (Kabat-Zinn, 1994). In addition, self-reported mindfulness and mindfulness exercises are both associated with better ability in shifting attention (e.g., Verhaeghen 2021). Mindful individuals are able to effectively and flexibly participate in or out of their experiences (Cho et al., 2016), leading to a more objective and acceptable experience of emotions. Flexible attention may break the downward spiral of negative emotions, leading to better recovery from negative emotions and ultimately to a decrease in PTSS.

The Mediating Role of GP

Surprisingly, the ability to generate positive emotions did not mediate the relationship between trait mindfulness and PTSS. According to Fredrickson's broaden and build theory, positive emotions help broaden individual momentary thought, and thus benefit personal resources. Individuals

with these resources are more likely to respond effectively to the challenges of life (Fredrickson, 2001). However, the results of the current study found that the ability to generate positive emotions has no significant predictive effect on PTSS. Prior studies have reported that individuals who have experienced chronic PTSS can and do experience positive emotions. Compared with peers who had not experienced major trauma, individuals who experienced trauma reported the same level of positive emotions (Dornbach-Bender et al., 2019). Therefore, compared to the benefit of positive emotion, the recovery from negative emotion may be more powerful in the mitigation of PTSS. In addition, PTSS may be more related to a difficulty in the regulation of emotions than to difficulty in experiencing positive emotions (Tull et al., 2007). For example, compared with college students without PTSS, college students with PTSS showed a lack of flexibility in emotional regulation, both in self-report and in laboratory behavioral tasks (Hannan & Orcutt, 2020). In addition to negative emotional dysregulation, positive emotional dysregulation is also an important factor in the development and maintenance of PTSS (Weiss et al., 2018, 2020). For example, individuals with positive emotional dysregulation may show no acceptance of positive emotions (e.g., when experiencing positive emotions, I feel afraid of them), have difficulty in controlling impulsive behavior (when I am happy, I cannot control my behavior), and other similar symptoms when experiencing positive emotions (Weiss et al., 2018, 2020). Finally, studies found that two weeks after a missile attack, individuals with high levels of negative or positive emotions experienced greater levels of PTSS in the following months (Israel-Cohen et al., 2014). Researchers have argued that during and shortly after traumatic events, arousal of positive emotions may be a sign of difficulty in emotion regulation, thus increasing the susceptibility of PTSS (Israel-Cohen et al., 2014). Therefore, positive emotions may also be a sign of difficulty in regulating emotions, which is not conducive to the alleviation of PTSS.

Limitations and Implications

While the findings of the current study offer novel and important contributions to research regarding possible mechanisms underpinning the relationship between mindfulness and PTSS, there are some limitations that should be considered. First, the study was cross-sectional in nature, and therefore, causal relationships cannot be discerned. Also, the long-term effects of mindfulness practice could not be examined. Second, the study used self-reported measures and thus, introspection and social-desirability biases may have affected the results. For example, individuals with different meditation experiences may have different ideas about trait mindfulness, such as what aspects of mental state should be considered when assessing (Van Dam et al., 2017).

Also, epidemiological experience and meditation experience were measured by self-made questionnaires, which contain only a few questions and may not fully describe an individual's relevant experience. Finally, this study only considered the role of emotional resilience in the relationship between trait mindfulness and PTSS. Future studies should examine other variables, such as positive emotional dysregulation, as mediators in the relationship.

Notwithstanding these limitations, this study has some important implications. Theoretically, compared with the ability of generating positive emotions, the ability of recovering from negative emotions is an important factor for mindfulness to relieve PTSS. Besides contributing to existing theory, our findings have practical implications as well. Prior traumatic experience is a risk factor for post-traumatic stress symptoms. Clinical workers should give more attention to groups who have had similar trauma experience. In addition, in order to relieve PTSS, individuals with PTSS are recommended to learn some emotion regulation skills, and practice mindfulness exercises, which can increase the levels of their mindfulness (Carmody & Baer, 2008).

Conclusions

The current study found that individuals who had previous epidemiological experiences were more likely to have PTSS during a major pandemic. It is critical that clinicians be particularly vigilant toward this group. In addition, the results indicated that during the COVID-19 pandemic, trait mindfulness was a protective factor against PTSS, and the relationship between mindfulness and PTSS was mediated by the ability to recover from negative emotions. Therefore, mindfulness practice may be beneficial to psychological adjustment during stressful events, such as the pandemic. Intervention aimed at improving mindfulness and emotional regulation may help reduce the risk of PTSS and promote post-traumatic adaptation, particularly in individuals who have prior traumatic experience.

Data Availability The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Conflict of Interest The authors declare that they have no conflict of interest.

Informed Consent Informed consent was obtained from all individual participants.

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