



ORIGINAL ARTICLE

Impact of continued mindfulness practice on resilience and well-being in mindfulness-based intervention graduates during the COVID-19 pandemic: A cross-sectional study

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Abstract

Aim: The coronavirus disease 2019 (COVID-19) pandemic has caused unprecedented stress. Mindfulness-based interventions (MBIs) are known to be effective in reducing stress. However, it is unclear how long-term outcomes differ between those who continue mindfulness practice after MBIs and those who do not. In this study, we hypothesized that those who continued mindfulness practice would have higher stress tolerance, and we examined this hypothesis through a survey of MBI graduates. In this study, we examined the association between the continuation of mindfulness practice among MBI completers and individual stress during the COVID-19 epidemic.

Methods: A cross-sectional survey of MBI graduates was conducted. The physical and mental health states were compared between those who established a habit of mindfulness practice (practice group) and those who did not (no practice group).

Results: The data were collected from 95 participants (response rate: 53.7%). Of the total respondents, 66 (69.5%) practiced mindfulness. Although the degree of perceived stress due to the COVID-19 pandemic was not statistically different between the practice and no practice groups, the practice group showed significantly lower levels of depression ($p = 0.007$), higher levels of resilience ($p = 0.006$), higher levels of overall health ($p = 0.006$), and higher levels of mental health ($p = 0.039$). The effect of mindfulness practice on reducing depression was fully mediated by resilience.

Conclusion: Among MBI graduates, those who regularly practiced mindfulness had lower levels of depression and higher levels of physical and mental health. Thus, the continuation of mindfulness practice increases resilience, buffers against new stressors such as the COVID-19 pandemic, and has the potential to prevent depression.

KEYWORDS

COVID-19, depression, distress, long-term practice, mindfulness-based interventions, resilience

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INTRODUCTION

The unprecedented coronavirus disease 2019 (COVID-19) pandemic has plunged the world into a highly stressful environment, causing a huge impact on global mental health.¹ Large-scale studies on the general population have suggested a high prevalence of anxiety and depression (16%–34%), subjective stress (8%), and insomnia associated with COVID-19.^{1–4} Rigorous infection prevention measures, such as wearing masks and social distancing, have significantly reduced interpersonal contact, tremendously changing the way people interact and communicate with each other.⁵ Besides the fear of getting infected, people have experienced secondary harmful effects, such as domestic violence, increased alcohol and tobacco abuse, and social isolation, resulting from quarantine and working from home.^{3,6} The impact of prolonged stress on mental health has been intense.⁷

The effectiveness of mindfulness-based interventions (MBIs), such as mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT), on chronic stress has been well established.^{8–11} A few follow-up studies have shown that MBIs prevent depression recurrence and reduce anxiety even after the completion of the interventions. However, evidence for the long-term effects of MBIs is scarce.¹⁰

A substantial proportion of individuals who participate in MBIs are expected to continue mindfulness practice even after the completion of program. Kabat-Zinn reported in a 6–48-month follow-up study that an average of 75% of MBSR graduates practiced mindfulness meditation after completing the program.¹² Considering that long-term meditation practitioners undergo various affective, behavioral, and physiological changes,^{13,14} such as decreased rumination, decreased fear of emotion, and increased behavioral self-regulation, it is possible that MBI graduates who practiced mindfulness meditation daily might have responded differently to the stress caused by COVID-19, compared to those who discontinued mindfulness practice after the completion of the MBI program. Subsequently, the long-term physical and mental health states during the COVID-19 pandemic might differ between the two groups.

Previous research has shown that MBIs increase resilience.¹⁵ Resilience is the ability to adapt or change successfully in the face of adversity. An individual's resilience is an essential factor in their recovery from mental health problems.¹⁶ Thus, we assumed that people who practiced mindfulness meditation daily might be more resilient than those who do not, and this higher resilience might improve their ability to cope with the stress related to COVID-19, leading to mental stability.

In this study, we conducted a cross-sectional survey among individuals who received MBIs before the COVID-19 pandemic and compared the physical and mental health states under the stress of the COVID-19 pandemic of those who had a routine of mindfulness practice and those who did not. Furthermore, we analyzed the involvement of resilience in the effect of the continued mindfulness practice on mental health under the COVID-19 pandemic.

METHODS

Procedure

A cross-sectional questionnaire-based survey was conducted. Questionnaires measuring stress and mindfulness practices during the COVID-19 pandemic were distributed through the postal mail to participants who met the inclusion criteria. The data were collected anonymously. The survey period was from June 1, 2020 to June 30, 2020. From April 7, 2020 to May 25, 2020, the Japanese government announced a state of emergency due to COVID-19 and instructed people to refrain from unnecessary outings. This survey was performed immediately after the end of the state of emergency, suggesting that people responded to the survey in an uncertain condition due to the COVID-19 pandemic. This study was approved by the Ethics Committee of the authors' institution.

Participants

The following were included as participants: (1) those who attended at least 8 weeks of mindfulness-based programs that were conducted as different studies before May 2020 (mindfulness-based programs for healthy individuals,¹⁷ health care professionals,¹⁸ patients with anxiety disorders,¹⁹ or patients in interdisciplinary pain centers with chronic pain²⁰), (2) those who were 20 years or older at the time of the survey, and (3) those who provided written consent.

Those excluded were: (1) individuals who have difficulty reading and writing Japanese, (2) people with severe physical or psychological symptoms (e.g., cognitive dysfunction, disorientation, or severe depression), and (3) individuals inferred as unsuitable for participation by their physician in-charge.

Mindfulness interventions

The MBI was implemented as a program based on MBCT. The program consisted of group sessions and homework sessions. All programs included the raisin exercise (eating meditation), a body scan, breathing meditation, yoga, walking meditation, and compassion meditation. In addition to basic mindfulness meditation instructions, psychoeducation was provided for each group of participants (psychoeducation on well-being for healthy individuals, resilience for health care professionals, coping with anxiety for patients with anxiety disorders, and pain-sustaining beliefs and behaviors for patients with chronic pain). Instructors were psychiatrists, nurses, and clinical psychologists trained in MBSR or MBCT, with at least 5 years of meditation practice.

Measurements

A self-administered questionnaire was used to collect responses from the participants.

Sociodemographic characteristics

Sociodemographic characteristics included gender, age, marital status, number of people cohabitating, highest educational level achieved, job situation, and presence of physical and psychological illness.

Impact of COVID-19

To assess the impact of COVID-19 on daily life, participants were asked to report whether people close to them had been diagnosed with the COVID-19 infection. In addition, participants were asked to determine the degree of impact of the pandemic on their employment (e.g., loss of job, work transformed to telecommuting) and household income (decreased, no change, or increased).

Psychological states

We assessed the participants' depression, anxiety, and stress using the Depression Anxiety Stress Scale-21 (DASS-21),²¹ consisting of 21 items on a 4-point scale. The reliability and validity of the Japanese version of the DASS-21 have been verified.²²

To measure post-traumatic stress symptoms, we used the Impact of Events Scale-Revised (IES-R), a widely used scale to evaluate symptoms of post-traumatic stress disorder (PTSD).²³ The IES-R is a 22-item, 5-point scale that assesses intrusive symptoms, avoidance symptoms, hyperarousal symptoms, and sleep disturbance. The reliability and validity of the Japanese version of the IES-R have been verified.²⁴

Sleep conditions were assessed using the Athens Insomnia Scale (AIS).²⁵ The AIS includes eight items on a 4-point scale indicating the severity of insomnia over the past month. Participants were categorized according to their total score as having no insomnia (1–3 points), probable insomnia (4–5 points), or insomnia (6 or more points). The reliability and validity of the Japanese version of the AIS have been verified.²⁶

Quality of life

We used the Short Form-8 (SF-8) to measure the participants' quality of life (QOL). The SF-8 is a comprehensive measure of health-related QOL composed of eight domains including physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health, along a 5-point scale.²⁷ The score for each domain was calculated as a deviation score based on national norms (50 points). In addition, the physical summary and mental summary scores were calculated by multiplying the scores of the domains that are closely related to the body (physical functioning, role physical, bodily pain, and general health) and mind (vitality, social functioning, role emotional, and mental health). The Japanese version of the SF-8 has been validated.²⁸

Resilience

The Connor-Davidson Resilience Scale (CD-RISC)²⁸ was used to measure psychological resilience against adversity. The CD-RISC consists of 25 items on a 5-point scale, with higher scores indicating higher resilience. The Japanese version of the CD-RISC has been validated.²⁹

Mindfulness practice as a daily habit

We investigated whether the participants practiced mindfulness meditation as a daily habit by asking, "Do you have a routine of mindfulness practice?" The participants who answered "yes" were defined as the practice group, and those who answered "no" were defined as the no practice group. For the practice group, additional questions were asked to investigate the average duration of weekly mindfulness practice (how many minutes per day and how many times per week you practice mindfulness meditation).

Perceived usefulness of mindfulness on COVID-19

To investigate how mindfulness affected participants' stress associated with COVID-19, we used the following questions: "Do you feel stress related to COVID-19?" on a 5-point scale ranging from "strongly agree" to "strongly disagree" and "Has mindfulness helped you cope with the stress caused by COVID-19?" on a 5-point scale of "very helpful," "fairly helpful," "neither helpful nor unhelpful," "not very helpful," and "not helpful." The participants who answered "very helpful" or "fairly helpful" were asked to describe how mindfulness was helpful. Those who responded otherwise were asked to provide specific reasons why they felt mindfulness was not helpful.

Data analysis

We compared sociodemographic characteristics, the impact of COVID-19, and stress-related factors between the practice and no practice groups using a *t* test for continuous variables and a χ^2 test for categorical variables. For qualitative survey items, responses were categorized based on thematic analysis.³⁰

To examine the effect of resilience on the association between routine of practicing mindfulness and depression, we conducted a mediation analysis using the bootstrapping method.³¹ The analyses were adjusted for potential confounding factors, including age, sex, number of cohabitations, status of infection with COVID-19 in oneself and others, COVID-19 impact on work, and COVID-19 impact on income. Variables were standardized, and 5000 permutations were performed to generate each effect and 95% confidence intervals (CI).

All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) Version 25.0 (IBM Corp).

PROCESS 3.0 extension was utilized for mediation analysis.³² Statistical significance was determined using two-tailed p values of <0.05 .

RESULTS

Sociodemographic characteristics

Questionnaires were distributed through the postal mail to 177 people, of whom 95 responded (response rate: 53.7%). The mean age of the respondents was 51.2 years old, and females accounted for 73.7% of the participants. Twenty health care workers were included in the respondents (mean age: 45.6 years old, 85% female).

Of the total respondents, 69.5% ($n = 66$) practiced mindfulness at the time of the survey. Of the 66 participants who continued to practice mindfulness, 17 (25.8%) were health care professionals. The median of the average weekly practice time for mindfulness meditation in the practice group was 25 min (mean: 40 min, range: 3–210 min). The background factors of the practice and no practice groups are shown in Table 1. There was no statistical difference between the practice and no practice groups in terms of gender, marital status, highest educational level achieved, job situation, physical or psychological illness comorbidities, and the proportion of health care workers. The only difference between the two groups was in the number of people cohabiting ($p = 0.029$).

Impact of the COVID-19 pandemic

The impact of COVID-19 on participants' daily life is shown in Table 2. Regarding contact with COVID-19, 9% of the practice group and 17% of the no practice group experienced an infection or suspected infection in themselves and their surroundings, which showed a significant difference ($p = 0.037$). Regarding the impact on work, 23% of the practice group and 24% of the no practice group reported a transition to telecommuting. There was no difference in the percentage of participants who lost their job due to COVID-19 and household income between the practice and no practice groups ($p = 0.196$). More than 70% of the respondents in the practice and no practice groups answered "strongly agree" or "agree" to the question asking whether they feel stress induced by the COVID-19 pandemic. There was no statistically significant difference between the two groups on this parameter ($p = 0.557$).

Stress-related factors, QOL, and resilience

The quantitative data of stress-related factors were compared between the practice and no practice groups (Table 3). The practice group showed significantly lower levels of depression ($p = 0.007$), higher levels of resilience ($p = 0.006$), higher levels of overall health states ($p = 0.006$), and higher levels of mental health states ($p = 0.039$)

than the no practice group. There was no significant difference in PTSD-related symptoms between the two groups. The SF-8 scores in the two groups were lower than the national average of 50 points for all subscales.

Perceived usefulness of mindfulness

Responses to the question, "Has mindfulness helped you cope with the stress caused by COVID-19?" and the categories of helpful and unhelpful reasons for mindfulness are shown in Figure 1. Of the total respondents, 52% answered mindfulness to be "very helpful" or "fairly helpful." The most frequently mentioned reasons for mindfulness being helpful were "peaceful mind," "awareness of myself, breath, and this moment," and "self-compassion." The primary reason for mindfulness not being helpful was the "failure of habituation."

Mediating the effect of resilience on the association of mindfulness practice continuation with depression

Figure 2 and Table 4 show the mediation analysis results, examining the effect of a routine of practicing mindfulness on depression through resilience. There was a significant association between the routine of mindfulness practice and resilience (path a) and between resilience and depression (path b). The standardized indirect effect (path $a \times b$) was significantly lower (-0.1445 ; 95% CI = -0.2969 to -0.0388). The standardized direct effect (path c) was -0.1409 (95% CI = -0.331 to 0.0493 ; $p = 0.1443$), suggesting a full mediation model of resilience for the effect of a routine of practicing mindfulness on depression.

DISCUSSION

In this study, we examined whether a routine of mindfulness practice in MBI graduates was related to better physical and mental health states in the highly stressful environment caused by the COVID-19 pandemic. Those who established a mindfulness practice as a daily habit showed a lower level of depression than those who did not, while the degree of stress due to COVID-19 was not statistically different between the two groups. Both the number of people living together and employment status possibly affected mental health and the practice habit. However, this study was performed under a specific circumstance, that is, the COVID-19 pandemic, suggesting that generalization of the associations should be considered with caution. Furthermore, the effect of routine mindfulness practice on reduced depression was fully mediated by resilience. This suggests that resilience increased with continued mindfulness practice after the completion of MBIs, buffering newly occurring stress (such as that resulting from COVID-19) against depression. These findings consist of a survey performed during the COVID-19 pandemic in China, which showed that mindfulness practice protected mental

TABLE 1 Comparison of demographic characteristics between the mindfulness continuing group and discontinued group (N = 95).

	Practice group (n = 66)			No practice group (n = 29)			p-value
Age (years), mean (SD), range [min-max]	51.0	(11.1)	[23-80]	51.5	(10.8)	[37-75]	0.834
Sex, N (%)							
Male	20	(30.3)		5	(17.2)		
Female	46	(69.7)		24	(82.8)		0.183
Marital status, N (%)							
Unmarried	18	(27.3)		8	(27.6)		
Married	41	(62.1)		18	(62.1)		
Divorced or bereaved	7	(10.6)		3	(10.3)		0.999
Cohabitation, N (%)	22	(33.3)		4	(13.8)		
Living alone							
Living with two	18	(27.3)		16	(55.2)		
Living with three or more,	26	(39.4)		8	(27.6)		
No answer	0	(0.0)		1	(3.4)		0.029*
Education level, N (%)							
Below bachelor degree	25	(37.9)		11	(37.9)		
Bachelor	25	(37.9)		14	(48.3)		
Masters or Doctorate	14	(21.2)		3	(10.3)		
No answer	2	(3.0)		1	(3.4)		0.431
Not employed (including homemakers), N (%)	12	(18.2)		13	(44.8)		0.007**
With current physical illness, N (%)	24	(36.4)		14	(48.3)		0.275
With current mental illness, N (%)	11	(16.7)		9	(31.0)		0.094
Medical professionals, N (%)	17	(25.8)		3	(10.3)		0.090

Abbreviation: SD, standard deviation.

* $p < 0.05$; ** $p < 0.01$.

health and that frequency of the practice was associated with improvement of mental health.³³

The following are speculations on how the mindfulness practice increased the participants' levels of resilience and decreased their levels of depression.

In mindfulness practice, people are encouraged to direct their attention to the present moment, helping them focus on and accept the current situation. The United Nations Inter-Agency Standing Committee Guidance on Basic Psychosocial Skills for COVID-19 Responders proposed that people can differentiate between what can be and cannot be controlled to manage stress under the COVID-19 pandemic.³⁴ The practice of mindfulness helps people disengage from uncontrollable situations and focus on controllable ones. In fact, the major reason for our participants finding mindfulness helpful was "awareness of oneself, breath, and this moment." MBIs transform recipients' cognitive and emotional reactivity, resulting in reduced anxiety, and rumination, increasing their sense of self-control.³⁵ This also helped the

participants in our study to accept reality rather than ignore the stress during the COVID-19 crisis.

Furthermore, the MBI increased the participants' sense of psychological well-being and sense of security during the health-threatening situation of the COVID-19 pandemic. Mindfulness practice has been known to increase "body listening" and "body trusting" senses. These senses are part of interoceptive awareness and help people to actively listen to their body for insight and experience their body as safe and trustworthy.³⁶ Indeed, the participants' perceptions of their own "general health," which was measured using the SF-8, was significantly higher in the practice group than in the no practice group, which might be facilitated by their careful attention to and confidence in their body (higher levels of "body listening" and "body trusting").

Finally, increased compassion, which is known to be achieved by MBIs,³⁷ might have helped people to feel "connected" with others during the pandemic. Many of our participants reported compassion and self-compassion while answering how

TABLE 2 Impact of the COVID-19 epidemic on daily life (N = 95).

	Practice group (n = 66)		No practice group (n = 29)		p-value
Contact with COVID-19 infection, N (%)					
Have been infected with COVID-19	0	(0.0)	2	(6.9)	
Experienced suspected infection	1	(1.5)	0	(0.0)	
Family member infected	0	(0.0)	2	(6.9)	
Someone close (not a family member) was infected	5	(7.6)	1	(3.4)	
No one close to me has been infected	60	(90.9)	24	(82.8)	0.037*
Impact of COVID-19 on work, N (%)					
None (regular work, with commuting)	25	(37.9)	4	(13.8)	
Shifted to telecommuting	15	(22.7)	7	(24.1)	
Lost one's job	0	(0.0)	1	(3.4)	
Other	14	(21.2)	4	(13.8)	0.010*
Impact of COVID-19 on household income, N (%)					
Decreased	17	(25.8)	4	(13.8)	
No change	49	(74.2)	25	(86.2)	
Increased	0	(0.0)	0	(0.0)	0.196
Feeling stressed by COVID-19, N (%)					
Strongly agree	16	(24.2)	6	(20.7)	
Agree	31	(47.0)	15	(51.7)	
Neutral	6	(9.1)	1	(3.4)	
Disagree	9	(13.6)	5	(17.2)	
Strongly disagree	1	(1.5)	2	(6.9)	0.557

*p < 0.05

mindfulness practice was helpful. The compassion fostered by mindfulness practice might have helped the participants understand the suffering of others and feel connected to their society even in a socially isolating situation.³⁸

Moreover, continued mindfulness practice had a significant clinical impact on MBI graduates, even though their practice time was fairly short. The median duration of practice length in the practice group was 25 min/week, that is, approximately 3–4 min per day. This was much shorter than the standard MBI recommendation of 30 min of practice per day.³⁹

TABLE 3 Comparison of stress-related factors in the practice group and the no practice group (N = 95).

	Practice group (n = 66)		No practice group (n = 29)		p-value
DASS 21, mean (SD)					
Depression	4.36	(4.1)	7.6	(5.4)	0.007**
Anxiety	1.88	(2.5)	2.6	(2.2)	0.548
Stress	5.08	(3.9)	6.8	(5.6)	0.106
IES-R, mean (SD)					
Intrusion	5.21	(5.6)	6.0	(7.8)	0.581
Avoidance	5.62	(5.4)	6.7	(7.1)	0.482
Hyperarousal	4.39	(4.0)	5.7	(6.2)	0.238
PTSD, N (%)	10	(15.2)	7	(24.1)	0.271
AIS, N (%)					
Not insomnia	18	(27.3)	8	(27.6)	0.975
Probably insomnia	15	(22.7)	7	(24.1)	0.881
Insomnia	33	(50.0)	14	(48.3)	0.877
SF-8, mean (SD)					
Physical component summary	45.4	(7.8)	42.7	(9.9)	0.200
Mental component summary	43.8	(7.6)	41.3	(8.0)	0.149
Physical functioning	43.8	(10.6)	40.6	(12.1)	0.211
Role physical	46.4	(8.0)	43.2	(10.7)	0.146
Bodily pain	47.2	(9.0)	46.4	(11.3)	0.690
General health	48.2	(7.2)	43.5	(8.1)	0.006**
Vitality	46.9	(6.4)	43.9	(8.4)	0.057
Social functioning	39.9	(10.4)	38.4	(9.7)	0.527
Role emotional	44.4	(8.2)	42.0	(9.5)	0.208
Mental health	46.3	(7.3)	42.9	(7.4)	0.039*
CD-RISC, mean (SD)	61.48	(15.3)	49.7	(19.3)	0.006**

Abbreviations: AIS, Athens Insomnia Scale; CD-RISC, Connor–Davidson Resilience Scale; DASS 21, Depression Anxiety Stress Scale 21; IES-R, Impact of Event Scale-Revised; PTSD, post-traumatic stress disorder; SD, standard deviation; SF-8, SF8 Health Survey.

*p < 0.05; **p < 0.01.

The relationship between the dose (the amount of time practicing mindfulness at home) and effectiveness of mindfulness remains controversial. While some studies suggest that those who meditate for longer periods of time are more likely to experience significant improvement,^{40,41} others deny a significant correlation between the amount of time spent practicing mindfulness at home and clinical outcomes.^{42–45} However, our findings should be interpreted with caution since the time spent on mindfulness practice was based on the participants' self-reporting. Moreover, it is difficult to accurately determine the overall mindfulness practice time since

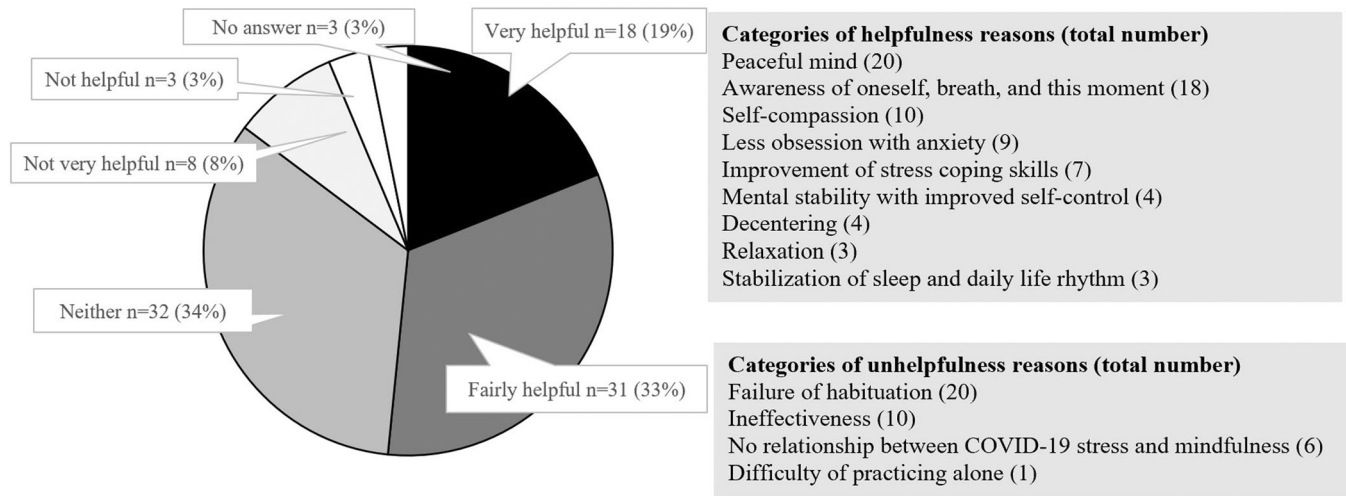


FIGURE 1 The proportion of respondents who found mindfulness helpful for stress due to COVID-19 and their reasons (N = 95).

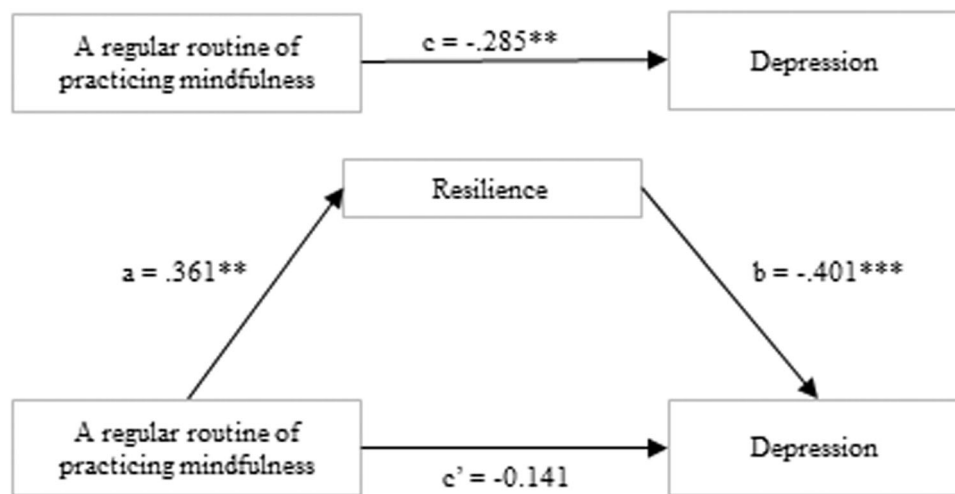


FIGURE 2 The mediating effect of resilience on the association of having a routine of mindfulness practice on depression. Path a, effect of mindfulness continuation on resilience. Path b, effect of resilience on depression. Path c', direct effect of mindfulness continuation on depression. Path c, total effect of mindfulness continuation on depression. **p < 0.01, ***p < 0.001.

there are two types of mindfulness practice—formal practice (e.g., sitting meditation) and informal practice (mindfulness in daily living)—and the time spent on informal practice is difficult to identify. Further studies are needed to address these issues.

In this study, the primary reason for the lack of benefit of mindfulness was “failure of habituation.” Hence, it is essential for instructors to support participants in continuing their mindfulness practice even after the completion of MBI programs. There are several ways of providing continuous support, such as implementing additional sessions (“booster sessions”), which has been associated with better treatment outcomes in MBIs for depression.⁴⁶ Community building as a place to continue mindfulness practice would also be useful. In fact, one of our participants mentioned that, “It was difficult to practice alone.” A community of practitioners and peers (a community called “Sangha” in Buddhism) is necessary to keep MBI

graduates motivated to continue mindfulness practice. Further, the development of apps and wearable devices that provide easier access to mindfulness practice would be helpful.

Limitations and suggestions for future studies

This study has several limitations. The participants were recruited from a single institution and predominantly included females. In a previous study, females were identified as a risk factor for depression related to COVID-19.² Furthermore, there may have been a bias in the respondents themselves who were included in the analysis. Among those who were continuing mindfulness practice as a daily habit, the response rate may have been higher among those who felt that mindfulness was effective. Similarly, among those who have not

TABLE 4 Bootstrapped multiple mediation analysis testing the indirect effect of regular mindfulness practice on depression via resilience.

	Standardized path coefficient	Bootstrap SE	t	BC 95% CI		p-value
				LL	UL	
Outcome: depression						
Path a	0.36	0.11	3.34	0.15	0.58	0.0013**
Path b	-0.40	0.09	-4.39	-0.58	-0.22	<0.001***
Path c'	-0.14	0.10	-1.47	-0.33	0.05	0.144
Indirect effects						
a × b	-0.14	0.07		-0.30	-0.04	
Total effect						
Path c	-0.29	0.10	-2.88	-0.48	-0.09	0.005**

Note: The table shows the path standardized coefficients for the total and indirect effects. The analysis controlled for age, sex, number of cohabitants, COVID-19 influence on work, COVID-19 influence on income, and contact with COVID-19 infection.

Path a, effect of mindfulness continuation on resilience.

Path b, effect of resilience on depression.

Path c', direct effect of mindfulness continuation on depression.

Path a × b, indirect effect of mindfulness continuation on depression.

Path c, total effect of mindfulness continuation on depression.

Abbreviations: BC 95% CI, bias-corrected bootstrap 95% confidence intervals; LL, lower limit; SE, standard error; UL, upper limit.

Path coefficients are based on 5000 bootstraps for the indirect effect. LL and UL CIs were used to determine the statistical significance of indirect effects.

** $p < 0.01$; *** $p < 0.001$.

continued to practice mindfulness, it is possible that the more dissatisfied they are with mindfulness, the more they responded. This limits the generalizability of our findings.

Our sample was heterogeneous. Our sample contained healthcare workers, patients, and healthy individuals. Although there was no difference in the severity of psychological distress between healthcare workers and non-healthcare workers, it was highly likely that the healthcare workers had higher stress levels as the study was conducted immediately after the first declaration of a state of emergency due to COVID-19 in Japan.

Moreover, with any observational study, there will be unmeasured confounders. People with depression and low resilience may have potential risk factors other than the habituation of mindfulness practice. Future randomized controlled trials adjusting for the unassessed factors are needed to examine the effects of a routine of mindfulness practice in MBI graduates.

Furthermore, major risk factors for depression, such as social support, financial situation, and neuroticism, were not evaluated. As the current study was conducted anonymously, the participants' backgrounds and mental states before starting the MBI program were not investigated in this study. These factors might have influenced participants' willingness to continue mindfulness practice after the completion of the MBI program and their psychological states at the time of the survey. Moreover, we were unable to assess the mindfulness traits of participants at the time of study.

Finally, our study could not identify a causal relationship between the routine of mindfulness practice and stress reduction because of the cross-sectional design. We have also not been able to examine changes in resilience and depression over time. In this study, the effect of mindfulness was not separated from the effect of continued training. Future study is required to identify the effect of continued training on resilience without mindfulness effects.

CONCLUSION

Our findings showed differences in the physical and mental health states under the stressful conditions of the COVID-19 pandemic with respect to daily mindfulness practice in MBI graduates. The participants who had a routine of mindfulness practice showed lower depression and higher resilience than those who did not, even under the same level of stress exposure. These results suggest that continuous mindfulness practice might buffer against new stress and reduce depression by increasing resilience.

DISCLOSURE STATEMENT

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

All authors contributed to the conception and design of the study. Chisato Tanaka, Kenta Wakaizumi, and Daisuke Fujisawa performed

the material preparation, data collection, and analyses. Chisato Tanaka wrote the first draft of the manuscript, and all authors commented on the previous versions of the manuscript. All authors read and approved the final manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The datasets analyzed during the current study are available upon reasonable request. Analyzed data in this study are available under the permission of the Institutional Review Board of Keio University School of Medicine corresponding to each request (<https://www.ctr.med.keio.ac.jp/rinri/>).

ETHICS APPROVAL STATEMENT

This study was approved by the Institutional Review Board of Keio University (approval number: 2020-0096) and was conducted according to the principles of the Declaration of Helsinki. The return of the questionnaire was considered as consent to the study.

PATIENT CONSENT STATEMENT

All study participants provided informed consent.

CLINICAL TRIAL REGISTRATION

N/A.

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