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The Effects of a Brief Mindfulness Intervention on Mindfulness, Stress and Emotional Intelligence in Medical Students

Ken Joey Loh[1,2,3], Azizah Othman[1,2], Cheng Kar Phang[4]

[1]*School of Medical Sciences, Universiti Sains Malaysia, Kelantan, MALAYSIA*

[2]*Hospital Universiti Sains Malaysia, Kelantan, MALAYSIA*

[3]*Department of A-Level, Sunway College Kuala Lumpur, Selangor, MALAYSIA*

[4]*Behavioural Health Centre, Sunway Medical Centre, Selangor, MALAYSIA*

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ABSTRACT

This study aimed to evaluate the effects of a brief mindfulness-based intervention (b-MBI) on the levels of mindfulness, perceived stress and emotional intelligence (EI). Fifty-nine undergraduate students in medicine course were randomly allocated to either 4 weekly b-MBI sessions (n = 30) or waitlist control (n = 29). All participants completed Mindful Attention Awareness Scale (MAAS), Perceived Stress Scale (PSS-10) and USM Emotional Quotient Inventory (USMEQ-i) at pre- and post-intervention. Findings from mixed-factorial ANOVA revealed significant cross-over interactions, but no significant main effects of treatment conditions and time, on mindfulness and perceived stress. Post-hoc analyses indicated intervention group to experience significantly increased levels of mindfulness (p = 0.012) and decreased perceived stress (p = 0.003) at post-intervention, which were unobserved in the controls. Significant main effect of time was observed (p = 0.001) for EI; however, only intervention group reported significant increase in the scores (p = 0.004). The lack of between-group treatment effects could be justified due to relatively low stress and high EI for intervention and control groups at baseline. Nonetheless, within-group findings provided preliminary evidence that b-MBI may be beneficial in improving mindfulness, perceived stress and EI. This intervention may be adapted into the medical curriculum to improve the psychological well-being of medical students.

Keywords: *Mindfulness, Mindfulness-based intervention, Emotional intelligence, Perceived stress, Medical students*

CORRESPONDING AUTHOR

Azizah Othman, Department of Pediatrics, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia

Email: azeezah@usm.my

INTRODUCTION

Stress during undergraduate medical training has been consistently reported since the past decade, with the most common stressor being academic challenges (1). In Asia, the prevalence of stress among undergraduate medical students is high: Saudi Arabia 53% to 63% (2–4), Pakistan 60% (5) and Bangladesh 54% (6). In Malaysia, the prevalence of significant stress among medical students ranged from 26% to 49% (7–9).

As stress is often correlated with psychological problems, it is not uncommon to observe an increase in the prevalence in anxiety and depression among the medical students. Studies indicated that the most prominent mental health issues affecting medical students are anxiety (41% to 57%), depression (12% to 31%) and stress (12% to 49%) (3, 7–8, 10–11). Longitudinal studies have demonstrated the prevalence of psychological distress and emotional disorders in medical students to range between 22% to 36% (12–13), which was higher than what was found in the general population in Malaysia (6% to 18%) (14). These alarming signs indicate that if stressors are not appropriately managed, they are likely to expose students to be more at risk and vulnerable for developing serious emotional, physical and psychological problems (15).

Mindfulness is "a state of awareness that arises through intentionally attending to present-moment experience, non-judgementally and acceptingly" (16). The concept of mindfulness has gained its popularity in both scientific and general communities over the years, as a means of dealing with a variety of physical and psychological issues, as well as promoting emotional regulation and stress management. Mindfulness training promotes exploratory attention to present-moment experiences regardless of its emotional valence, allowing individuals to be in touch with moment-to-moment experiences without judgement, which may lead to a state of relaxation, acceptance, self-regulation and cognitive change (17–18). In other words, training in mindfulness assists an individual to be more aware of their own emotions and develop a receptive stance towards unpleasant emotions, which can improve cognitive, behavioural and emotional flexibility overtime (19–21).

Mindfulness-based interventions (MBIs), such as mindfulness-based stress reduction (MBSR) (16) and mindfulness-based cognitive therapy (MBCT) (22), have been widely adopted in clinical and non-clinical settings to help practitioners cultivate mindfulness in their daily life (23). Numerous randomised controlled trials (RCTs) of MBSR have found beneficial effects of mindfulness interventions on a broad range of psychological outcomes, including improved cognitions (23), resilience and stress reduction (24–25), emotional functioning and responding (26), empathy and self-compassion (27), as well as overall physical and psychological well-being (28–29). These MBIs have also been found to reduce stress via mediating physiological responses.

There are evidences that mindfulness meditation have resulted in decreased sympathetic nervous system arousal (30), decreased cardiovascular reactivity and blood pressure, as well as improved cardiovascular recovery and heart-rate variability (HRV) indices after stress induction (31–33). These findings suggest that mindfulness practices are beneficial in reducing physiological responses in response to stress, thereby generating a state of relaxation and reducing emotional consequences towards these stressors.

Additionally, cross-sectional studies have proposed links between mindfulness and various emotional mechanism, coping and outcomes. Bao et al. (34) have demonstrated mindfulness to be a significant predictor of self and others' emotion appraisals, regulation of emotion and the use of emotion in guiding reasoning.

Regular practice may also help practitioners in increasing clarity and awareness of their emotional states, as well as lowered distraction and mind-wandering (35–37). Such increase in emotional awareness could facilitate better emotion regulation abilities (38–39). Increasing awareness of one's own emotions can in turn enhance the ability to recognise and understand emotions and perspectives of others (40). Therefore, a more mindful individual might be more capable of understanding others' experiences with empathy and compassion, and convey responses through warmer emotional tones, acceptance and positive affects (41–42).

Correspondingly, emotional intelligence (EI) is identified as one of the psychosocial variables that could potentially buffer the detrimental effects of stress and protect one's psychological health. EI is the ability "to perceive emotions, to access and generate emotions so as to assist thought, to understand emotions and emotional knowledge, and to reflectively regulate emotions so as to promote emotional and intellectual growth" (43). Individuals with high EI are found to be more motivated, positive and resilient when faced with difficulties in life, as they are able to channel their frustration, stress, disappointment and other negative emotions into positive and rational perspectives (44). EI is also positively associated with psychological well-being, such as happiness and life satisfaction, better physical well-being, and improved academic and work performance (45–47). In contrast, individuals lacking in EI skills might experience more difficulties in controlling and regulating their own emotions, hence more prone to stress and burnout (44, 48). These findings highlighted the protective and emotionally buffering effects of EI in safeguarding the psychological health of an individual.

By putting these findings into medical training context, it is plausible to infer that higher EI in medical students may be associated with similar beneficial effects on the core competencies required of medical doctors. Higher EI is indeed linked to better competencies as outlined in the Accreditation Council for Graduate Medical Education (ACGME) in the United States. Systematic reviews by Morales (49) and Arora et al. (50) reported positive relationships between EI and more empathetic and compassionate patient care, improved medical knowledge, better teamwork and doctor-patient relationships as well as effective coping with organisational stress and leadership. Additionally, EI is positively correlated with patients' trust and satisfaction, improved doctor-patient relationship and negatively associated with perceived stress and depressive/anxiety symptoms at work (42, 51–52). In short, research findings suggest that medical students who have higher awareness and understanding of their own and others' emotions may possess better patient-care abilities, as well as better coping abilities with the demanding clinical environment.

Taken together, an intervention programme that can exert beneficial effects on reducing stress and stress-related problems, as well as enhancing EI skills, may be beneficial for medical students. This is because such intervention not only helps students to adapt better to the stressful medical training environment (therefore improving their overall well-being); at the same time it enhances their EI to equip them in other areas of medical training. Therefore, medical schools are urged to design special training programme to provide medical students with the essential self-help skills by targeting on EI (11, 27, 53).

The present study aimed to evaluate the effects of a brief mindfulness-based intervention (b-MBI) programme in reducing stress and improving mindfulness and EI among medical students studying in a public university in Malaysia. A b-MBI is an abbreviated version of MBSR, which typically spans across 4 to 6 weeks, with weekly group-based sessions of 1.5 to 2 hours, complemented with 5 to 20 minutes of daily home-based

exercises (54). One evidence-based b-MBI programme in Malaysia is the MINDFULGym programme developed by Dr. Phang Cheng Kar, a psychiatrist and trained mindfulness teacher. This programme is a brief (4 to 5 sessions, 2 hours per week) group mindfulness programme designed to help medical students cope with stress. To the best of the author's knowledge, its effectiveness has been backed by 10 published studies in local contexts, with four studies demonstrating the effectiveness of this programme in undergraduate medical students studying in a public university in Malaysia. These studies have consistently found that such intervention has exerted significant improvements in mindfulness, perceived stress, psychological distress, life satisfaction, subjective happiness and general psychiatric symptoms (54–57). Nonetheless, since this programme was validated within a particular medical student community in Malaysia, the generalisability of these findings to Malaysian medical students at large remains to be addressed.

In the present study, we developed an alternative form of b-MBI programme that operated on the MBSR principles as a four-weeks' intervention. We hypothesised that participants in the intervention group would report significant increase in mindfulness and overall EI, as well as decrease in stress at post-intervention, as compared to the control group. We also predicted there would be a negative correlation between mindfulness and perceived stress, and a positive correlation between mindfulness and EI.

METHODS

Design, Participants and Procedure

This study was a non-blinded randomised controlled study, as the trainer of the intervention was unblinded to the treatment conditions.[1] The b-MBI programme was advertised in the medical campus via social media and in-class presentation, where interested participants signed up by scanning the QR code attached on the advertisement flyer. Seventy potential participants who expressed their interest to participate in the programme were screened for eligibility and seven were excluded due to being diagnosed with chronic mental and physical illnesses or undergoing counselling and/or psychotherapy during the study period. The remaining 63 eligible participants were stratified according to their years of studies (i.e., Year 1, 2 and 3) and randomised into intervention (n = 32) and waitlist control (n = 31) groups. This stratified randomisation was done using Microsoft Excel randomisation procedure. Four participants did not complete the programme, thus were excluded from the final analyses. The final sample thus comprised of a total of 59 participants (Intervention: n = 30; Control: n = 29; N = 59).

Written informed consent was obtained from all participants, and ethical approval was granted by the USM Human Research Ethics Committee (USM/JEPeM/19050301). Figure 1 summarises the study flow.

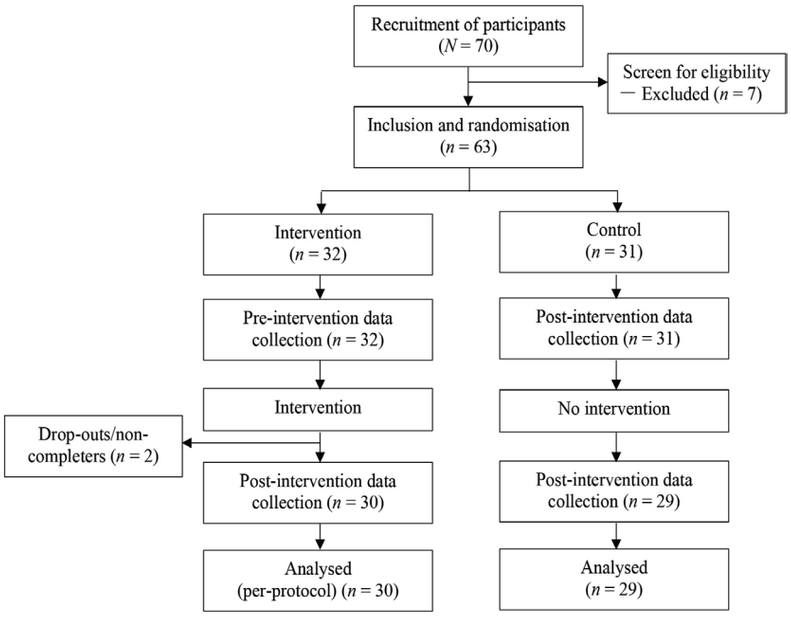

Figure 1: Flow of the study.

Intervention

The b-MBI is a 4-weeks intervention programme, which was developed in reference to the principles of the 8-weeks MBSR programme (16), MBCT (22), and MINDFULGym (55–56, 58–60) – a locally developed mindfulness programme for Malaysian population. The programme is structured into four themes: (a) paying attention in the present-moment experiences; (b) adopting beginner's mind which is the child-like curiosity in observing the experiences; (c) developing non-judgemental awareness and acceptance of negative thoughts; as well as (d) experiencing gratitude, self-compassion and loving-kindness. The themes were taught across four weeks, with each theme being introduced explicitly using six mindfulness exercises to assist participants in grasping the full concept of mindfulness. Both formal and informal mindfulness exercises were incorporated which include mindful exploration, labelling, grounding, gratitude workout and Mindful-S.T.O.P. (S – Stop the busyness temporarily; T – Take three deep mindful breaths, and attend to bodily sensations; O – Observe with curiosity, and label three sounds/sights around us; P – Proceed with whatever we need to do with a mindful stance and a smile).

Participants attended 1 hour and 30 minutes weekly group meetings and completed of 5 to 10 minutes of daily mindfulness exercises at home, for four consecutive weeks. Home-based exercises required participants to do mindfulness activities as guided by the pre-recorded audio-scripts. They needed to also record their experiences during these exercises in a mini diary for monitoring and recording purposes. Checking-in involved reviewing the earlier exercises and sharing personal experiences in group. The group sessions were instructed by a trainee clinical psychologist (first author) who had 2 years of experiences practising mind-body exercises, and been trained and supervised by a clinical psychologist (second author) and the creator of the MINDFULGym programme (third author). The current module had been validated by experts and summarised in Table 1.

Table 1: The outline of b-MBI

Week	Content
1	Introduction to mindfulness Introduction to "focusing on the present moment" Labelling and grounding techniques** Mindful breathing* Mindful muscle relaxation* Home practice
2	Check-in Introduction to beginner's mind Mindful exploration** Mindful eating* Mindful-S.T.O.P. (short version)** Home practice
3	Check-in Introduction to biological and psychological symptoms of stress using cognitive-behavioural model Body scan* Leaves on a river (cognitive defusion exercise)* Home practice
4	Check-in Introduction to self-compassion, gratitude, loving-kindness Gratitude workout** Loving-kindness exercise* Mindful-S.T.O.P. (expanded version)** Wrap-up and review Home practice

Notes: *Formal mindfulness exercise; **Informal mindfulness exercise

Measures

Mindful Attention Awareness Scale (MAAS) (61) was utilised to measure the core characteristic of mindfulness, specifically the levels of awareness and attention to the present-moment experiences. Questions were rated using a six-point Likert scale, ranging from 1 (almost always) to 6 (almost never). An example of the items included "It seems I am running on automatic, without much awareness of what I am doing". The scores of the 15 items were totalled to obtain an overall score that ranged between 15 to 90, where higher scores reflected higher levels of mindfulness. In this study, the internal consistency of MAAS was excellent at baseline (Cronbach's $\alpha = 0.91$) and post-intervention (Cronbach's $\alpha = 0.92$). The reliability strength was consistent with the internal consistency found in a number of validated MBI studies in Malaysian medical students (Cronbach's α ranged 0.88 to 0.89) (54–56, 58, 60, 62).

Perceived Stress Scale (PSS-10) (63) was used to assess participants' appraisal of their life as being stressful. These 10-items questionnaire required participants to rate the degree to which their lives had been unpredictable, uncontrollable and overloading for the past month. The items were designed on a five-point Likert scale, from 0 (never) to 4 (very often). An example of the items included "In the last month, how often have you felt you were unable to control the important things in your life?"

Item responses were summed after reverse-scoring four items, yielding a total score for perceived stress. The total score ranged from 0 to 40, where higher scores reflected higher levels of perceived stress. For studies conducted on Malaysian medical student population, studies have consistently found good to excellent internal consistency of PSS-10 (Cronbach's α ranged 0.88–0.90; (54–56, 63). In the present study, the PSS-10 scores obtained at both pre-intervention and post-intervention showed good internal consistency (pre: Cronbach's α = 0.85; post: Cronbach's α = 0.83).

USM Emotional Quotient Inventory (USMEQ-i) (64) is a 46-items scale used to measure the level of EI, or emotional quotient (EQ) on seven dimensions: emotional control, emotional maturity, emotional conscientiousness, emotional awareness, emotional commitment, emotional fortitude and emotional expression. The items were designed on a five-point Likert scale, ranging from 0 (not like me) to 4 (totally like me). An example of the items included "I can focus on what I do even when I am stressed". The scores were totalled and averaged to provide an overall EI score that ranged between 0 and 4, where higher scores reflected higher levels of overall EI.

This questionnaire has been validated on medical applicants and medical students from multiethnic, multireligion, and multicultural backgrounds (13). Reliability analysis showed high internal consistency of overall USMEQ-i (Cronbach's α ranged 0.94–0.97), and all the subscales showed acceptable to excellent reliability: emotional control (α = 0.90), emotional maturity (α = 0.82), emotional conscientiousness (α = 0.83), emotional awareness (α = 0.79), emotional commitment (α = 0.77), emotional fortitude (α = 0.66), and emotional expression (α = 0.60) (13). In this study, the overall USMEQ-i demonstrated excellent internal consistency (pre: Cronbach's α = 0.95; post: Cronbach's α = 0.96).

This scale includes a faking index to assess the possibility of faking responses, such as the tendency of respondents to overrate oneself. Similar to other domains, items on faking index scale were summed and averaged to obtain scores that ranged between 0 and 4. These scores were further categorised into: low (0.00–2.00), average (2.01–2.99), and high (3.00–4.00). Low faking scores indicated that there was no tendency of overrating oneself, hence the test results of USMEQ-i were considered reliable. Average faking scores indicated that there was some tendency of overrating oneself, but the test results could still be considered reliable with acceptable accuracy. High faking scores, on the other hand, indicated that there was a tendency of overrating, hence the results might be less reliable and should be interpreted with caution. In the present study, responses on the faking index had Cronbach's α values of 0.77 and 0.80 for pre-intervention and post-intervention, respectively.

Participants' demographic information was obtained including age, gender, ethnicity, religion and year of study. Participants were provided with a mini diary to record the type of mindfulness exercise(s) that they practised daily, and to briefly describe their experiences during the exercise. These diary entries were not included in the analysis. In addition, a feedback questionnaire was constructed to obtain the participants' feedbacks on aspects such as usefulness and feasibility of the programme.

Data Collection

Baseline data collection was performed one week prior to the commencement of the intervention. The Google Forms link which contained the baseline questionnaires were emailed to all participants, and they were required to enter their subject IDs which was attached in the email in order to complete the questionnaires. Participants in the intervention group underwent the 4-weeks intervention programme, whereas waitlist controls did not participate in any

intervention during the four weeks. Follow-up data for both groups were collected using the same method at one week after the intervention.

Statistical Analyses

Per-protocol analysis was performed on the data from 59 participants (intervention: n = 30; control: n = 29), from the original participant pool of N = 63. In other words, participants who were non-completers, i.e., attended less than two sessions of the mindfulness intervention and missed the post-intervention assessment (n = 4, 6.35%; intervention: n = 2; control: n = 2) were considered as dropouts and excluded from the analyses. An alternative of per-protocol analysis would be the intention-to-treat (ITT) analysis, which includes every participant who has been randomised according to the random group assignment without taking into account non-compliance, protocol deviations and withdrawal (65). We argued that it was more appropriate to conduct per-protocol analysis instead of ITT analysis, as the main objective of this study is to evaluate the feasibility of this pilot intervention and its effects on the medical students' well-being. In addition, we achieved a compliance rate of 93.7%, therefore, these analyses could be conducted without significant loss of data.

All data collected were entered and analysed using Statistical Package of Social Sciences (SPSS), version 25.1, Mac OS version. Data exploration confirmed that the grouped data for "mindfulness" and "overall EI" for both treatment conditions at baseline and post-intervention met the normality assumption (tested using Shapiro-Wilk, skewness and kurtosis) and were normally distributed. They also met the assumption of homogeneity of variance and covariance.

Shapiro-Wilk test revealed that all data in PSS-10 were normally distributed except the data of control group at post-intervention. Yet the skewness and kurtosis tests suggested that the symmetry of data is within the acceptable range. Levene's test also revealed that the post-intervention PSS-10 data, but not the pre-intervention PSS-10 data, violated the homogeneity of variance assumption. Given that the group sizes were relatively equal (i.e., ratio of largest to smallest group was less than 1.5), thus the F statistic may be robust to this assumption, parametric test were employed and reported. Nonetheless, non-parametric tests (Mann-Whitney U-test on difference scores) were also conducted on PSS-10 total scores to ensure the replication of results.

For the main analyses, we evaluated the effects of condition (intervention vs. control) and time (baseline vs. post-intervention) on each of the primary outcome measure of MAAS, PSS-10 and USMEQ-i scores. These were conducted using a series of mixed ANOVAs, where the pre- and post-intervention data were entered as within-subject variables (time), with condition (intervention vs. control) entered as a between-subject variable. Statistical significance of the main effects and interaction were evaluated at $p < 0.05$. For any significant main effect and/or interaction, post-hoc analyses were conducted for between-group differences and/or within-group differences. For each between-group and within-group comparison, the mean differences were compared against Bonferroni-corrected α, by dividing α value of 0.05 by the number of comparisons.

Effect sizes for mixed ANOVAs are presented as partial eta-squared ($\eta^2_{partial}$), where $\eta^2_{partial}$ = 0.01 represents small effect size, $\eta^2_{partial}$ = 0.06 medium effect size, and $\eta^2_{partial}$ = 0.14 represents large effect size. Effect sizes for t-tests (post-hoc) are computed as Cohen's d, where d = 0.3 represents small effect size, d = 0.5 medium effect size, and d = 0.7 large effect size.

RESULTS

Demographic and Baseline Information

Participants' demographic and baseline information are presented in Table 2. Mann-Whitney U test revealed no significant differences in age between treatment and control groups: $U = 414.00$, $z = -0.339$, $p = 0.735$. Chi-square tests of association also revealed no significant association between the treatment groups and any of the categorical variables: range of χ^2 values = 0.00–0.87, $p > 0.05$. There were also no significant differences between treatment groups and control at pre-intervention on any of the primary outcome measures: MAAS [$t(57) = -1.37$, $p = 0.176$]; PSS-10 [$t(57) = 0.957$, $p = 0.343$]; USMEQ-i [$t(56) = 0.280$, $p = 0.780$].

Table 2: Demographic and baseline information ($N = 59$)

Characteristics	Intervention, $n = 30$	Control, $n = 29$	Test statistics	
	n (%)	*n* (%)	χ^2	*p*
Gender				
Male	9 (30.0)	10 (34.5)	0.14	0.713
Female	21 (70.0)	19 (65.5)		
Ethnicity[a]				
Malay	21 (70.0)	22 (75.9)	0.26	0.613
Chinese	7 (23.3)	4 (13.8)	0.87	0.347
Indian	2 (6.7)	3 (10.3)	0.26	0.484
Religious affiliation[a]				
Islam	21 (70.0)	22 (75.9)	0.26	0.613
Buddhism	7 (23.3)	4 (13.8)	0.87	0.347
Hinduism	2 (6.7)	3 (10.3)	0.26	0.484
Year of study				
Year 1	7 (23.3)	7 (24.1)	0.00	0.942
Year 2	15 (50.0)	12 (41.4)	0.44	0.506
Year 3	8 (26.7)	10 (34.5)	0.43	0.514
	Mean (SD)	**Mean (SD)**	**Test statistics**	
Age	20.47 (1.70)	20.21 (0.81)	$U = 414.00$, $z = -0.339$, $p = 0.735$	
MAAS	59.37 (11.09)	62.93 (14.02)	$t(57) = -1.37$, $p = 0.176$	
PSS-10	18.93 (6.95)	17.41 (5.07)	$t(57) = 0.957$, $p = 0.343$	
USMEQ-i	2.95 (0.43)	2.92 (0.46)	$t(56) = 0.280$, $p = 0.780$	

Notes: Degree of freedom (*df*) for Chi-square tests, $df = 1$; [a]Chi-square and *p*-values were reported using Fisher's exact test.

In both intervention and control groups, the baseline perceived stress scores were in the category of "low stress" level. Similarly, according to the categorisation of USMEQ-i, participants in both conditions reported high EI levels at baseline. Inspection into the faking index of USMEQ-i for both intervention and control groups indicated reliable and acceptable responses, as the mean responses for both groups at pre- and post-intervention laid in the range of 2.00 and 3.00. These suggest that participants who signed up for the programme already had high EI and were not undergoing significant amount of stress before the intervention started.

Primary Outcomes

The descriptive and inferential findings conducted on the primary outcome variables: MAAS, PSS-10 and overall EI (USMEQ-i); are summarised in Table 3. The interaction graphs for each primary outcome measures can be found in Figure 2. There was a pattern of increased state of mindfulness from pre- to post-intervention in the intervention group, but the control group showed a decreased pattern. Results from mixed ANOVA revealed a significant cross-over interaction between treatment condition and time, $F(1, 57) = 6.019$, $p = 0.017$, $\eta^2_{partial} = 0.096$; but no significant main effects of condition, $F < 1$, $p = 0.867$, $\eta^2_{partial} = 0.00$; and time, $F < 1$, $p = 0.335$, $\eta^2_{partial} = 0.016$. Post-hoc tests, with Bonferroni adjusted α levels of 0.025 per test (0.05/2), showed that there were significant within-group differences in the intervention group, but not the control group. Specifically, there was a statistically significant increase in MAAS scores from pre- to post-intervention for the intervention condition, $t(29) = 2.68$, $p = 0.012$, $d = 0.62$, not the control condition, $t(28) = 0.96$, $p = 0.346$, $d = 0.20$. No significant difference in MAAS scores was obtained between the groups at both pre-intervention, $t(57) = 1.37$, $p = 0.176$, $d = 0.36$ and post-intervention, $t(57) = 1.50$, $p = 0.138$, $d = 0.39$.

Similarly, there was a pattern of decreased perceived stress levels from pre- to post-intervention in the intervention group, whilst the control group reported the opposite. Results from mixed ANOVA revealed a significant cross-over interaction between treatment condition and time, $F(1, 57) = 11.95$, $p = 0.001$, $\eta^2_{partial} = 0.173$; but no significant main effects of condition, $F < 1$, $p = 0.346$, $\eta^2_{partial} = 0.016$; and time, $F(1,57) = 1.90$, $p = 0.173$, $\eta^2_{partial} = 0.032$. Post-hoc tests, with Bonferroni adjusted α levels of 0.025 per test (0.05/2), showed that while perceived stress levels between the groups did not differ significantly at baseline, there was a significant group difference in the intervention condition following the four weeks of mindfulness intervention. In particular, participants who underwent the intervention reported significantly lower stress levels (Mean = 15.00, SD = 5.46) than those who did not (Mean = 19.10, SD = 6.62) one week after the intervention, $t(57) = 2.60$, $p = .012$, $d = 0.68$. A significant decrease in the total PSS-10 scores from pre- to post-intervention was also evident for the intervention group, $t(29) = 3.18$, $p = 0.003$, $d = 0.63$, but not the control group, $t(28) = 1.61$, $p = 0.119$, $d = 0.29$. Mann-Whitney test on scores of differences (post-intervention scores subtracted from pre-intervention scores) similarly revealed that there were significant differences in PSS-10 scores between the intervention and control groups, as intervention group reported significantly greater change in PSS-10 scores from pre- to post-intervention as compared to the control group, $U = 227.50$, $z = –3.15$, $p = 0.002$.

Thirdly, there was an increased pattern in the overall EI from pre- to post-intervention in both treatment conditions, $F(1, 55) = 11.68$, $p = 0.001$, $\eta^2_{partial} = 0.175$. There was no significant main effect of condition, $F < 1$, $p = 0.326$, $\eta^2_{partial} = 0.018$; and interaction, $F(1,55) = 2.67$, $p = 0.108$, $\eta^2_{partial} = 0.046$. Post-hoc paired sample *t*-tests using Bonferroni-corrected alpha ($\alpha = 0.025$) revealed that the increase in the overall EI scores from baseline to post-intervention was significant for participants who attended the intervention, $t(27) = –3.19$, $p = 0.004$, $d = 0.49$, but not for the controls, $t(28) = –1.45$, $p = 0.159$, $d = 0.18$.

Table 3: Pre- and post-intervention scores for MAAS, PSS-10 and USMEQ-i by time and condition

Variable	Intervention (n = 30) Mean (SD)		Control (n = 29) Mean (SD)		Condition		Time		Time × condition	
	Pre-	Post-	Pre-	Post-	*F*	*p*	*F*	*p*	*F*	*p*
MAAS	58.43 (11.04)	65.37 (11.40)	62.93 (14.02)	59.93 (16.06)	0.03	0.86	0.94	0.33	6.02	0.017*
PSS-10	18.93 (6.95)	15.00 (5.46)	17.41 (5.07)	19.10 (6.62)	0.91	0.34	1.90	0.17	11.95	0.001***
USMEQ-i	2.96 (0.44)	3.18 (0.45)	2.92 (0.46)	3.00 (0.45)	0.98	0.32	11.68	0.001***	2.67	0.10

Notes: Degrees of freedom (*df*): MAAS (1, 57); PSS-10 (1, 57); USMEQ-i (1, 55).
MAAS, PSS-10 and USMEQ-i (overall EI): Significance level is assessed at α = 0.05. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

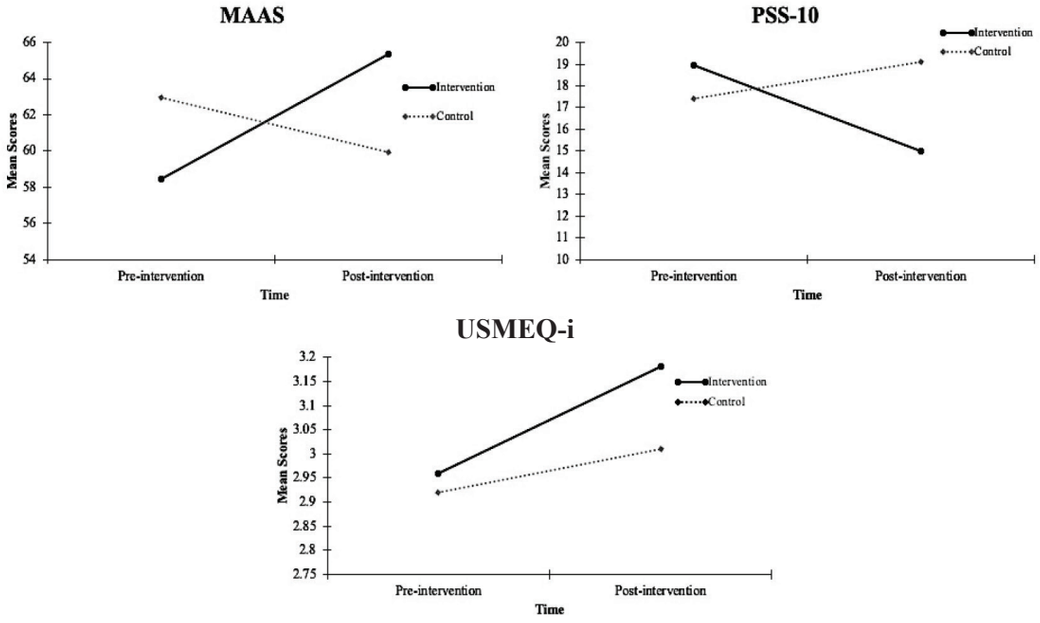

Figure 2: Interaction graphs for MAAS, PSS-10 and USMEQ-i.

A series of bivariate Spearman's rank correlations were conducted between all pairs of post-intervention scores of MAAS, PSS-10 and overall EI (USMEQ-i), for both intervention and control conditions. As seen in Table 4, at post-intervention, significant negative associations were found between MAAS and PSS-10 in both intervention, $r_s(28) = -0.501$, $p = 0.005$, and control, $r_s(27) = -0.457$, $p = 0.013$. Squared correlation coefficients indicated that 25.1% and 20.9% of the variance in reduction of perceived stress experienced by participants in the intervention and control condition, respectively, could be explained by the effects of mindfulness. No significant association was found between mindfulness and overall EI scores in both interventions, $r_s(27) = 0.303$, $p = 0.110$, and control, $r_s(27) = -0.016$, $p = 0.935$. On the other hand, there was a significant negative relationship between perceived stress scores and overall EI in the intervention group at post-intervention: $r_s(27) = -0.494$, $p = 0.006$, indicating that about 24.4% of variance in the decreased perceived stress scores could be explained by increased EI.

Table 4: Correlations between post-intervention scores for each outcome variables

	MAAS	PSS-10	USMEQ-i
MAAS	1.00	–0.501**	0.303
PSS-10	*–0.457**	1.00	–0.494**
USMEQ-i	*–0.016*	*–0.314*	1.00

Notes: Top diagonal of the table represents Spearman's rank correlation coefficients (r_s) for the intervention group; bottom diagonal of the table represents Spearman's rank correlation coefficients (r_s) for the control group (italicised). Significance level of each Spearman's rho correlation coefficient: $^{*}p < 0.05$; $^{**}p < 0.01$.

Attendance and Compliance

Thirteen (43%) participants attended all four-day groups sessions, 14 (47%) attended three out of four sessions and 3 (10%) attended two out of four sessions. Participants spent an average of 6.45 days performing mindfulness exercises in the first week, 5.77 days in the second week, 5.81 days in the third week, and 4.89 days in the fourth week. They spent around 34 to 63 minutes in the first week, 28 to 60 minutes in the second week, 30 to 59 minutes in the third week, and 29 to 60 minutes in the fourth week performing the mindfulness exercises.

Feedbacks on the b-MBI Programme

Table 5 presents the feedbacks of the programme collected from the participants in the intervention group. In general, all participants found the programme to be useful for medical students. Most participants (97%) found the programme to be beneficial and easy to follow; and they would recommend this programme to friends and relatives. Participants also generally found the audio-guides to be helpful for their mindfulness practices at home (70%), though there were several participants who claimed that they did not use the audio-guides to practise and thus were unsure about its helpfulness (23%).

With regard to the helpfulness of mindfulness exercises, most participants reported "mindful breathing" (80%) and "Mindful-S.T.O.P. " (70%) to be the most helpful method of practising mindfulness and reducing stress. Participants also reported "body scan" and "leaves on a river" meditation exercises to be the least beneficial of all the mindfulness exercises (53.3% and 33.3%, respectively).

In terms of qualitative feedbacks, some participants expressed the feelings of improved calmness, mood and attention after the group sessions and home practices. Participants also particularly liked the nature of the mindfulness sessions that involved interaction and sharing of mindfulness experiences between the participants. It was also reportedly helpful when the mindfulness exercises were practised under the guidance of the instructor in the sessions. Some participants also suggested that this programme should be included in the medical curriculum. Nonetheless, some participants have suggested for the duration of each group session to be increased so that more activities can be performed to assist in understanding the exercises. More group sharing and discussion can also be encouraged so that participants would be more open with their experiences and learn more from each other.

Table 5: Participants' feedbacks about the "Be Mindful, Be Well" programme

Feedback	Agree (%)	Disagree (%)	Not sure (%)
1. I find the programme beneficial for me.	97	0	3
2. I find the programme easy to understand.	97	3	0
3. I find the mindfulness exercises useful.	90	0	10
4. I can easily follow the instructions of the mindfulness exercises.	97	3	0
5. I find the instructor of the programme knowledgeable.	100	0	0
6. Overall, I find the audio-guides helpful for my mindfulness practices.	70	7	23
7. I think this programme is useful for medical students.			
8. I would recommend this programme to my friends and relatives.	100 97	0 0	0 3

DISCUSSION

This study examined the effects of a four weeks of b-MBI on the levels of mindfulness, perceived stress and EI among undergraduate medical students. Despite having no significant main effect of between-group treatments on mindfulness and perceived stress, the significant interactions between treatment groups and time points revealed that participants experienced a significant increase in mindfulness level and a significant decrease in perceived stress level following the intervention. The effect sizes were medium to large. There was a pattern of increase in the overall EI scores from baseline to post-intervention in both intervention and control conditions, but this increase was statistically significant only in the intervention group, with a medium effect size. These findings supported our hypotheses that medical students who participated in the b-MBI have improved on their levels of mindfulness, perceived stress, and EI, and these effects were not observed in the control group.

The first finding that b-MBI has significantly increased the levels of mindfulness is in line with the previous studies that investigated the effects of MBIs on health professional students, who reported moderate effects of improvement from baseline to post-intervention (55–58, 60, 66–67). Similar to the present study, these studies adopted modules from MBSR (16) and MBCT (22) to cultivate the state of mindfulness among the participants (68). These findings suggest that the b-MBI has successfully increased the state of mindfulness among the medical students who regularly practised mindfulness exercises during the intervention.

Second, the stress reduction effects are consistent with the local and international studies (25, 56, 58, 60, 68–70). These could be accounted by the calming and relaxing effects induced by regular mindfulness practices, as noted from the participants' feedbacks and testimonials during weekly check-in sessions, and entries from the weekly mini diaries. Specifically, most participants reported that they regularly practised mindful breathing and Mindful-S.T.O.P. to calm their mind, improve their mood, reduce distraction and sharpen their focus whenever they were stressed out about assignments and examinations. Some participants also reported improved sleep quality following 3 to 5 minutes of mindful breathing, body scan and mindful muscle relaxation exercises before sleep.

There were several empirical explanations as to how mindfulness could generate

such calming and relaxing effects that subsequently reduced stress perception. Regular mindfulness or meditation exercises could induce stress reduction via mediating physiological changes (71). A recent meta-analysis reviewing five RCTs revealed small to moderate effect sizes for MBIs on reducing cortisol secretion, which in turn reduced the reactivity of hypothalamic-pituitary-adrenaline (HPA) axis (72–73). These findings suggested that mindfulness exercises could enhance one's resilience and assist the body in quickly returning to a homeostatic state during stressful situations. On the other hand, psychological explanations such as the cognitive reappraisal (74) and mindfulness-to-meaning (20–21) theories could also account for the stress reductions effects following the b-MBI. According Lazarus and Folkman (74), an individual's stressful experience was cognitively mediated, as individuals appraised the significance of a stressor relative to its context, in which a situation would be evaluated as threatening when the demands presented by the stressor exceeded one's coping resources. Therefore, the open-monitoring, non-judgemental nature of mindfulness practices taught in the b-MBI might have helped in this process of reappraisal. Specifically, mindfulness facilitates one to detach oneself from the emotional experiences, "decenter" from stress appraisals, break off automatic emotional reactions, and widen the scope of attention to acknowledge previously unattended contextual information, which together allows one to reappraise the situation adaptively (75–76). Putting this notion in the context of the present study, it is plausible to infer that the teaching of Beginner's Mind, as well as non-judgemental awareness and acceptance of internal experiences, had facilitated participants to appraise day-to-day situations with a new perspective – with curiosity, an open mind and non-judgemental stance. This mindful appraisal technique might encourage alternative, more adaptive evaluation of day-to-day situations that would usually be perceived as stressful by medical students, such as compact deadlines and assignments, thereby reducing their perception of stress.

As suggested by previous literature, the significant reduction in stress perception in participants following the b-MBI might also be facilitated by the improvement in EI. We identified an increase in the overall level of EI in the intervention group following b-MBI, despite the lack of significant main effect of the group and interaction with the control group. Whilst prior studies have found an inverse relationship between EI and perceived stress (e.g., (77–78); some have found EI to partially mediate the link between trait mindfulness and perceived stress (e.g., 34, 79). In particular, the study by Bao et al. (34) reported that people with higher level of mindfulness were more likely to perceive better emotion regulation abilities, enabling faster recovery from distress, thereby leading to less perceived stress. They would also be more matured in the use of their emotions to motivate themselves to enhance performance, which then contributed to the reduction of stress.

How EI could bring about a reduction in stress perception links back to the beneficial effects exerted by mindfulness on EI, in particular emotional awareness and regulation. Mindfulness practices have regularly been shown to guide attentional self-regulation via awareness instilled by attending to the present moment, as well as acceptance of these momentary emotional experiences (16, 80). In fact, a recent research investigating the effects of an online 8-week MBI on EI of working adults, found an increased in trait mindfulness and all trait EI facets, except for the facet of empathy (81). In the present study, b-MBI that focused on non-judgemental attention and awareness to internal experiences might have facilitated participants to be more aware of their experiences, and cope with these experiences in non-judgemental and accepting way. In addition, the nature of our b-MBI which included the components of group sharing and interaction in the weekly sessions might have cultivated mindful

listening and expression of thoughts and emotions in the participants, which might in turn facilitate empathy and interpersonal relationship management. As noted in the feedback session, the group check-in and activities performed in the weekly sessions encouraged them to share and express their emotional experiences and how they utilised mindfulness to cope with these stressors in daily life. The expression of emotional experiences might not be something that they used to do in daily life with their peers. Besides, in the intervention programme, participants were encouraged to reflect on how they could foster a beginner's mind attitude in managing interpersonal relationships. Consistent practice might have fostered deeper understanding of others' experiences, enabling them to respond with more empathy and compassion, and communicating these responses using warmer emotional tones, acceptance and positive affect (41–42).

Nonetheless, the fact that the intervention had no significant main effect on EI, and the lack of significant correlation between mindfulness and EI, suggested that the propositions above need to be interpreted with caution. Despite the contradictions to the recent 8-week MBI study conducted by Nadler and colleagues (81), the non-statistically significant findings did not necessarily imply that our b-MBI had no impact on improving the EI. Rather, our briefer, 4-week study might have been successful at teaching participants a new emotional coping skill, but insufficient to develop awareness of internal experiences and empathy towards others; both of which are fundamental aspects of EI. More specifically, the regular mindfulness practices might have induced relaxing and calming effects when facing emotionally arousing situations, therefore fostering better management of emotions over time. Nevertheless, the theme of emotional awareness was only introduced in the third week of intervention, in which participants were introduced to identify and differentiate between thoughts, emotions, bodily sensations and behaviours using the cognitive-behavioural model. As a result, participants might not have sufficient opportunities to practise cultivating a mindful stance towards their own emotional experiences. Besides, to successfully increase social awareness (empathy), more time and practice of compassion-based mindfulness practices might be required (82–83). In the present study, the compassion-based exercises were only introduced during the final week of the intervention, again not allowing sufficient time for participants to practise and cultivate it in social situations before collecting the post-intervention data. Following this line of reasoning, future studies may consider expanding the 4-week b-MBI into a longer version so that the beneficial effects of mindfulness on EI can be further enhanced.

In summary, the present findings support that a mindfulness intervention programme of a briefer duration may be effective in stress reduction. This is an encouraging finding, as a shorter stress management programme might be less demanding on the medical students who are already facing high stress and tight schedules due to their academic workloads and clinical commitments. More importantly, the b-MBI showed preliminary effects on improvement in overall EI of medical students to a certain extent. To the best of the authors' knowledge, this study is the first to investigate the effects of a MBI on EI among medical students in Malaysia. This finding is of practical importance, as recent studies have urged for the need of incorporating early intervention programmes into medical schools due to the observed decrease in EI and psychological health of medical students with increasing years of study and academic demands (11, 27, 53). Aside from its mediating effects on stress perception, EI has been linked to increased positive outlook in life, cognitive flexibility, problem-solving abilities, coping and better interpersonal relationship management (50, 84–86). Though a longer duration of MBI is recommended to allow sufficient time for EI

to be developed, a short-term, cost-effective intervention package like the current b-MBI could serve as a useful mean to train some emotional regulation skills in medical students, in safeguarding their psychological well-being and promoting adaptive ways of dealing with the challenging medical training environment.

Limitations, Implications and Future Directions

This study is limited in several aspects. First, this study did not measure the long-term efficacy and effectiveness of the current b-MBI. Due to the lack of follow-up measures, we could not draw conclusions on the extent to which our brief mindfulness intervention had improved or sustained the stress reduction and emotion regulation abilities in the long term. To-date, longitudinal research into the beneficial effects of MBI on medical students' well-being are still scarce, though some of these studies did show significant improvement on psychological well-being, life satisfaction, and executive function to be maintained at 4- to 17-month follow-up (56, 87–88); as cited in the systematic review by Galante et al. (89). Nonetheless, another study by Kuhlmann et al. (90) found that the effects of an 8-week MBI on stress experience and effective coping of surgical interns in a Germany medical school were not sustained at 1-year follow-up. As for b-MBI conducted on Malaysian medical students, only one study to-date measured the long-term effects of the b-MBI at 6-month follow-up (55). Interestingly, only the improvement on self-efficacy was found to be maintained six months after the b-MBI programme, but improvement on mindfulness, perceived stress and mental distress were not sustained. With these mixed findings, it would be commendable for future studies to conduct follow-up studies at 6 to 24 months to investigate the longitudinal sustainability effects of b-MBI on the psychological well-being of medical students.

Additionally, the results need to be interpreted with caution due to the limitations in the design of our study. First, self-selected, thus motivated sampling recruitment accompanied by allowances of participation at any levels of mindfulness, perceived stress and EI resulted in a recruitment of participants presented with low levels of stress and relatively high levels of mindfulness and EI at baseline. This might have suppressed the effects of intervention observed in this study. In addition, their participation and compliance might be motivated by incentive, as well as motivation to reduce stress. Participants might have felt the obligation to provide "helpful" feedbacks at the post-intervention questionnaires, which might also have contributed to the possibility of inflation of self-reported ratings at post-intervention, especially in the control condition. We could not conclude with confidence that the observed effects of the intervention were unique to mindfulness training as the control was a passive group. Besides, the USMEQ-i is a newly developed measure lacking in concurrent, predictive, convergent and discriminant validity. Reliability analyses in the present study revealed some of the subscales to demonstrate poor to questionable internal consistency. Such limitation in reliability and validity of this tool might also impose on the generalisability of our findings in the local and global contexts. Additionally, the usefulness of our findings was limited, as we were only able to evaluate the effects of b-MBI on EI on a surface level, but not into the specific facets of EI such as emotional awareness, regulation, empathy and relationship management.

We recommend future research to include an active control group, such as teaching relaxation techniques in group format, for more accurate comparison with the mindfulness intervention group. Using larger samples with intrinsic motivation as well as including follow-up assessments to evaluate the long-term effects of b-MBI are commendable. Other mindfulness measures,

such as the Five Facets Mindfulness Questionnaire (FFMQ) (91) and Kentucky Inventory of Mindfulness Skills (KIMS) (92) can be considered in evaluating the effects of b-MBI. As brought up in the studies of mindfulness in the past few years, the unidimensional nature of MAAS only captured the use of present-moment attentional aspect of mindfulness, which may pose a limitation as it precluded the study from examining the effects of b-MBI on other aspects of mindfulness, such as non-reactivity to and non-judging of emotional experiences (55, 91). Therefore, the use of multidimensional scales such as FFMQ and KIMS may adequately capture the essence of b-MBI on different dimensions of mindfulness. The use of Wong Law Emotional Intelligence Scale (WLEIS) (93) to evaluate the effects of b-MBI on multiple dimensions of EI is also recommended, as it may improve generalisability of the results to the theories of mindfulness and EI.

CONCLUSION

The b-MBI may serve as a time- and cost-effective intervention package to help improve mindfulness, stress and EI among undergraduate medical students. It may be implemented as a preventive intervention in early medical curriculum to equip medical students with simple, adaptive mindfulness self-help skills in coping with the demand of medical training. The high compliance and low attrition rates suggest that this b-MBI was feasible and acceptable by medical students. Nonetheless, further studies are required to evaluate the efficacy and effectiveness of b-MBI on the levels of EI in medical students in Malaysia, using more widely validated EI measures.

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NOTE

1. Despite this being an unblinded study, efforts were taken to minimise researcher's bias from affecting the study. First, assessments of the outcome measures were done online via Google Forms by individual participants from home. Participants' responses on the outcome measures would only be identifiable via subject IDs to protect confidentiality. Second, participants were not explicitly told about whether they were being allocated to the intervention or control group. Specifically, participants allocated to the intervention group were told that they were assigned to the Four-Weeks' Mindfulness Training Programme; whereas the waitlist controls were told that they were assigned to the Half-Day Mindfulness Training Workshop which would commence on the 6th week from the present date. Third, random allocation of participants into the intervention or control group was done by an independent clinical psychology student who was not affiliated with the present study in any way.

ETHICAL APPROVAL

A written informed consent was obtained from all participants and ethical approval was granted by the USM Human Research Ethics Committee (USM/JEPeM/19050301).

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