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CLINICAL RESEARCH ARTICLE

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MBSR effects on positive psychological traits and experiential avoidance in head and neck cancer: a randomized controlled trial

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ABSTRACT

Background: Data on the effects of mindfulness-based stress reduction (MBSR) positive psychological traits and experiential avoidance (EA) among cancer patients are lacking.

Objective: This randomized controlled trial (RCT) aimed to: (1) compare the efficacy between MBSR and treatment-as-usual (TAU) control groups in increasing posttraumatic growth (PTG), hope, and optimism and reducing EA across time measurements (T_0, T_1, and T_2) among head and neck cancer (HNC) patients and (2) evaluate the mediation effects of hope, optimism, and EA on the relationship between MBSR and PTG.

Methods: A total of 80 HNC participants were randomized to MBSR ($n = 40$) and TAU ($n = 40$) groups with the researchers and data analyst blinded, and the group allocation of the participants was concealed. A one-hour MBSR session was conducted once a week, with 45 minutes of home assignments, for six weeks in the MBSR group. The outcomes across time measurements were compared using a mixed linear model following intention-to-treat (ITT) analysis. Mediation effects of hope, optimism, and EA on the relationship between MBSR and PTG were assessed with PROCESS.

Results: MBSR significantly increased the degree of optimism from T_0 to T_1 (mean difference = 1.825, 95% CI = 0.907–2.743, SE = 0.381, $p < .001$) with a medium effect size ($d = 0.563$) and from T_1 to T_2 (mean difference = 1.650, 95% CI = 0.829–2.470, SE = 0.328, $p < .001$) with a medium effect size ($d = 0.630$). Initially, MBSR did not increase the degree of hope from T_0 to T_1 ($p = .677$), but it significantly increased hope from T_1 to T_2 (mean difference = 2.524, 95% CI = 1.676–3.373, SE = 0.340, $p < .001$) with a medium effect size ($d = 0.735$). Conversely, MBSR did not sustain the changes in the degree of PTG and EA beyond T_1. EA partially mediated the relationship between MBSR and PTG, but not hope and optimism.

Conclusion: MBSR can be recommended as part of the treatment regimen for HNC patients.

Trial registration: ClinicalTrials.gov identifier: NCT04800419.

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PALABRAS CLAVE
Cáncer de cabeza y cuello; atención plena; reducción del estrés; evitación experiencial; optimismo; esperanza

HIGHLIGHTS

- Mindfulness-based stress reduction enhanced optimism and hope in cancer.
- Mindfulness-based stress reduction does not sustain posttraumatic growth and experiential avoidance in cancer.
- 6 weeks of mindfulness-based stress reduction enhanced positive psychological traits in cancer.

Efectos de MBSR en los rasgos psicológicos positivos y la evitación experiencial en pacientes con cáncer de cabeza y cuello: un ensayo de control aleatorizado

Antecedentes: Los datos sobre los efectos del uso de terapia de reducción del estrés basada en mindfulness (MBSR en sus siglas en ingles) en los rasgos psicológicos positivos y la evitación experiencial (EA) en pacientes con cáncer son escasos.

Objetivo: Este ensayo controlado aleatorizado (ECA) tuvo como objetivo: (1) comparar la eficacia entre los grupos de control tratados con MBSR y tratamiento habitual (TAU) para aumentar el crecimiento postraumático (PTG en sus siglas en ingles), la esperanza y el optimismo, y reducir la EA a con mediciones lo largo del tiempo (T0, T1 y T2) en pacientes con cáncer de cabeza y cuello (HNC en sus siglas en inlges) y (2) evaluar los efectos mediadores de la esperanza, el optimismo y la EA en la relación entre MBSR y PTG.

Métodos: Un total de 80 participantes con HNC fueron asignados aleatoriamente a los grupos MBSR ($n = 40$) y TAU ($n = 40$). Los investigadores y el analista de datos fueron enmascarados, y la asignación a los grupos de los participantes se mantuvo oculta. En el grupo de MBSR se realizó una sesión de MBSR de una hora semanalmente, con 45 minutos de tareas para hacer en casa, durante seis semanas. Los resultados a lo largo del tiempo se compararon mediante un

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modelo lineal mixto mediante un análisis por intención de tratar (ITT). Los efectos de mediación de la esperanza, el optimismo y la EA en la relación entre MBSR y PTG se evaluaron con PROCESS.
Resultados: MBSR aumentó significativamente el grado de optimismo de T0 a T1 (diferencia de medias = 1,825; IC del 95% = 0,907 a 2,743; EE = 0,381; $p < 0,001$) con un tamaño del efecto medio ($d = 0,563$) y de T1 a T2 (diferencia de medias = 1,650; IC del 95% = 0,829 a 2,470; EE = 0,328; $p < 0,001$) con un tamaño del efecto medio ($d = 0,630$). Inicialmente, la MBSR no aumentó el grado de esperanza de T0 a T1 ($p = 0,677$), pero sí la aumentó significativamente de T1 a T2 (diferencia media = 2,524; IC del 95% = 1,676 a 3,373; EE = 0,340; $p < 0,001$) con un tamaño del efecto medio ($d = 0,735$). Por el contrario, la MBSR no mantuvo los cambios en el grado de PTG y EA más allá de T1. La EA medió parcialmente la relación entre la MBSR y el PTG, pero no la esperanza y el optimismo.
Conclusión: La MBSR puede recomendarse como parte de la rutina de tratamiento para pacientes con cáncer de cabeza y cuello.

1. Introduction

Head and neck cancer (HNC) patients may suffer from a lowering in the quality of life (QOL), which may ultimately affect their survival rate (Bhandari et al., 2024). Nevertheless, HNC patients may also experience posttraumatic growth (PTG) (Nik Jaafar et al., 2021). PTG refers to an improvement in psychological functioning as a result of struggling with a traumatic or highly stressful event, surpassing pre-traumatic or pre-stress levels. One essential factor for the development of PTG in response to the traumatic experience of having cancer is the acceptance of the traumatic event. Acceptance of living with cancer is closely associated with accepting unpleasant and painful thoughts and emotions (Nik Jaafar et al., 2021). Experiential avoidance (EA) refers to the avoidance of thoughts, feelings, memories, and internal experiences, which disrupt psychological equilibrium (Hayes et al., 1996). Thus, a lower degree of experiential avoidance may favour the development of PTG.

Positive psychological traits that may facilitate the occurrence of PTG are hope and optimism. Hope is a dispositional trait that motivates a person to engage with strategies to achieve goals. A greater degree of hope contributes to higher levels of QOL and spirituality among cancer patients. There is a positive association between hope and PTG in HNC patients (Ho et al., 2013). Conventionally, optimism is a motivational state with a tendency to perceive outcomes in life in a positive manner. Optimism facilitates the development of PTG in cancer patients by driving a person to forego unattainable goals in life. This facilitates threat appraisal and search for meaning out of the traumatic event, thereby enhancing PTG (Nik Jaafar et al., 2022). Hence, it is essential to assess the degrees of hope and optimism in HNC patients, particularly their relationship with PTG.

One of the psychosocial interventions to increase PTG in cancer patients is mindfulness-based stress reduction (MBSR), which is traditionally conducted once a week for a duration of eight weeks (Ng et al., 2020). Given the various negative psychological complications associated with HNC, it is essential to investigate the extent to which MBSR enhances PTG, optimism, and hope and reduces EA in HNC patients. Nevertheless, data regarding the effects of MBSR on EA, hope, and optimism among HNC patients remain scarce. Therefore, to address this research gap, this study aimed to: (1) compare the changes in PTG (primary outcome), optimism, EA, and hope (secondary outcomes) between MBSR and treatment-as-usual (TAU) groups across time points ($T_1 = 6$ weeks after the commencement of randomization, which is immediately post-intervention, and $T_2 = 12$ weeks after completion of intervention for follow-up assessment) and (2) evaluate the mediating effects of EA, optimism, and hope on the relationship between MBSR and PTG among HNC patients.

2. Methods

2.1. Trial design and participants

This study was a multi-centre, two-arm, parallel-group, double-blinded, randomized controlled trial (RCT), comparing MBSR intervention and treatment-as-usual (TAU) control groups according to the ethical standards of the Helsinki Declaration of 1964 and its subsequent amendments. No changes were made to the methodology after trial commencement. The original research protocol is included in Supplementary Appendix 1.

To ensure adequate statistical power, a priori power analysis was performed with G*Power 3.1.9.222. Following Labelle et al. (2015), a small effect size of 0.17 was applied. Considering a type I error of 0.05 with a two-tailed approach, 74 respondents (37 per group) would be necessary to achieve a power of 0.8, accounting for an anticipated dropout rate of 20%. Thus, the estimated total sample size needed was 44 subjects per group.

Participants were recruited from the Oncology outpatient clinics and inpatient wards of three referral medical centres for oncology in Malaysia. Recruitment was conducted by a trained research assistant who was not involved in the study and was unaware of the study objectives. Before enrolment, participants provided informed consent, underscoring their voluntary engagement in the research. Participants retained the prerogative to withdraw from the study at any time. The drafting of our report adhered to the CONSORT guidelines.

The inclusion criteria were: (1) those with a diagnosis of HNC confirmed by histopathology report and at any stage of cancer, (2) those treated with surgery or undergoing the standard regimen of clinical anti-tumor treatment (chemotherapy, radiotherapy, immunotherapy, targeted therapy, etc.), and (3) individuals aged 18 years and above. Patients were excluded if: (1) they had cognitive impairment (screened by Mini Mental State Examination with a score of 24 or below), (2) they had psychiatric disorders (e.g. psychosis, bipolar mood disorder, posttraumatic stress disorder, substance and alcohol use) that could hinder their participation in the study (screened with Mini International Neuropsychiatric Interview), (3) they were previously or currently receiving any other form of psychological therapy intervention, (4) they were pregnant, or (5) they were physically unfit to perform the MBSR intervention. Any patients who met all eligibility criteria were offered to participate in the study.

2.2. Participant randomization

Participants were randomized into two groups (MBSR and TAU groups) by stratified permuted block randomization with an allocation ratio of 1:1, stratified by age (18–45 years, 46–65 years, and >65 years) and stage of cancer (stages 1, 2, 3, and 4). Randomization was performed by the research assistant (not part of the research team) using a computer-generated randomization sequence, where the allocation sequence was enclosed in an opaque envelope and given to the participants.

2.3. Blinding

The researchers were blinded, as participant recruitment, randomization, and data collection were conducted by trained research assistants not part of the research team. The data analysis was conducted by statisticians (who were not part of the research team and not aware of the objectives of the study), following the pre-planned statistical analysis protocol, prior to unlocking the data for the researchers. The allocation of the participants to their respective groups were concealed. Additionally, equal session duration, session numbers, and session frequencies per week were ensured for both the MBSR and TAU control groups. The same therapists were selected to conduct sessions in both groups, giving equal attention and time to participants. Each session lasted for one hour, with one session per week for six weeks.

The groups' identities were also blinded (i.e. named as groups 1 and 2).

2.4. Intervention

Both MBSR and TAU control groups were administered as group therapy, with each group comprising five participants.

The MBSR intervention was delivered as a one-hour session once a week, with 45 minutes of home assignments, for a duration of six weeks based on the therapy format developed by Kabat-Zinn (1990). The MBSR sessions are summarized in Supplementary Table 1, and details of the MBSR manual are presented in Supplementary Appendix 2.

The intervention sessions in the TAU control group utilized non-therapeutic and non-specific approaches. Participants received equal time and attention from the therapists, who also conducted the MBSR sessions. Additionally, participants in this control group received treatment-as-usual for their cancer therapy.

2.5. Treatment fidelity

The interventions in both groups were administered by four postgraduate students in psychology (in each targeted centre) who were not involved in the study and had at least two years of experience conducting psychotherapy sessions. To ensure treatment fidelity, audio recordings of the MBSR sessions were assessed by an experienced psychiatrist and a clinical psychologist using the Mindfulness-Based Interventions: Teaching Assessment Criteria. The details of the treatment fidelity are presented in Supplementary Appendix 3.

2.6. Minimization of contamination bias

We implemented a few preventive measures to minimize contamination bias if the participants in the control group were inadvertently exposed to the MBSR intervention. The details of the preventive measures are summarized in Supplementary Appendix 4.

2.7. Monitoring and conduct of the trial in all the targeted centres

A trial monitoring committee was formed, led by the principal investigator. Research and trial coordinators were elected in each trial centre (AMDI, HUSM, and UKMMC). The trial in all three centres was conducted according to the steps and procedures mentioned in the research protocol approved by the institutional human research ethics committees. The trial monitoring committee monitored the day-to-day conduct of the study and held online meetings once a week and face-to-face meeting once a month to resolve any issues that arise, recruit and train research assistants (two research assistants in each centre), recruit and train therapists (four therapists in each centre), and audit the trial and prepare reports to be submitted to the institutional human research ethics committees.

2.8. Procedures

Directly following randomization, the participants were provided with an allocation instruction detailing

the group to which they were assigned and the associated task. They were administered the sociodemographic and clinical characteristics questionnaire, Malay versions of the Posttraumatic Growth Inventory-Short Form (PTGI-SF), the Life Orientation Test-Revised (LOT-R), the Acceptance and Action Questionnaire 2nd Edition (AAQ-II), and the Dispositional Hope Scale (DHS). These instruments were administered at three time points (T_0: baseline assessment prior to the intervention, T_1: assessment immediately upon completion of the intervention at week 6, and T_2: assessment 12 weeks after the completion of the intervention).

2.9. Outcomes

2.9.1. Primary outcome (posttraumatic growth)

The Malay version of the PTGI-SF was used in this study to measure PTG. The PTGI-SF comprises five domains similar to the PTGI. A higher score indicates a greater level of PTG (Cann et al., 2010). The Malay version of the PTGI-SF was validated and adapted for use among cancer patients in Malaysia, demonstrating good internal consistency (Cronbach's alpha = 0.887) and confirming the five domains (Azman et al., 2017).

2.9.2. Secondary outcomes

2.9.2.1. Optimism. The Malay version of the LOT-R was employed to assess the level of optimism. The LOT-R has two domains (optimism and pessimism). A higher total score indicates a greater degree of optimism (Scheier et al., 1994). The Malay version of the LOT-R was adapted and validated among cancer patients in Malaysia and confirmed to have two domains (Leong Abdullah et al., 2017).

2.9.2.2. Hope. The Malay version of the DHS was used to evaluate the level of hope. Higher scores indicate a greater degree of hope (Everson et al., 1996). The Malay version of the DHS was adapted and validated for use among cancer patients in Malaysia and exhibited good internal consistency (Cronbach's alpha = 0.716) (Leong Abdullah et al., 2018).

2.9.2.3. Experiential avoidance. The Malay version of the AAQ-II was used to assess the degree of EA. Higher AAQ-II scores indicate higher EA (Bond et al., 2011). The Malay version of the AAQ-II was translated and adapted among cancer patients in Malaysia and exhibited good internal consistency (Cronbach's α = 0.91) (Shari et al., 2019).

2.9.3. Other measures

2.9.3.1. Sociodemographic and clinical characteristics. The sociodemographic data collected from all participants included age, gender, ethnicity, monthly household income, education level, and marital status. The clinical characteristics data collected included types of HNC, duration since diagnosis, stage of cancer, and site of subject recruitment. The details of the sociodemographic and clinical characteristics questionnaire are illustrated in Supplementary Appendix 5.

2.10. Statistical analysis

Data analysis was conducted using SPSS version 29. Sociodemographic and clinical characteristics were reported in frequency and percentage. Chi-square test and Fisher exact test were utilized to evaluate any differences in sociodemographic and clinical characteristics between the ACT and TAU groups.

To achieve objective (1), ITT analysis was carried out using a mixed linear model (those who completed at least up to T_1 assessment were retained for data analysis). The mixed linear model enables the use of data with incomplete time points of assessment. We selected the confounding factors to be included in the mixed linear model by comparing the Akaike's Information Criterion (AIC) of the model when each confounding factor was entered. We found that the inclusion of age produced the best-fit model. Hence, age was included and adjusted in the mixed linear model. To account for the differences in the baseline scores between MBSR and TAU groups, the baseline score was adjusted by including it as a covariance, rather than as part of the outcome variables. The changes in the dependent variable across time points (T_1 and T_2), such as PTG (primary outcome), EA (secondary outcome 1), optimism (secondary outcome 2) and hope (secondary outcome 3) in the MBSR and TAU control groups were compared after adjusting for age and with the baseline score as the covariance. The main effects of group, time, and interaction between group and time were computed. Then, post-hoc comparison of the total PTG, AAQ-II, DHS, and LOT-R scores between the MBSR and TAU control groups at each time points (T_0, T_1 and T_2) (between subject mean difference) and the post-hoc comparison of the total PTG, AAQ-II, DHS and LOT-R scores across the time points in each of the MBSR and TAU groups (within subject mean difference) were analysed. Effect size (Cohen's d) was also calculated, in which Cohen's d of 0.2, 0.5, and 0.8 were considered as small, medium, and large effect sizes, respectively. Statistical significance was set at $p < .05$ and using a two-tailed approach.

Sensitivity analysis with per protocol (PP) analysis was also performed. Those who did not complete the minimum number of required intervention sessions (at least five sessions in each of the assigned groups) were excluded from analysis.

Initially, the differences in the AAQ-II, LOT-R, DHS, and PTGI-SF scores between pre-treatment (T_0) and follow-up (T_2) were computed (total score at T_2 – total score at T_0). Then, Pearson's correlation

coefficient was computed between the AAQ-II, LOT-R, DHS, and PTGI-SF scores. To achieve secondary objective (2), mediation analysis was performed using PROCESS Macro-Version 4.2. This study used a single-mediator model (model 4) to examine the total, direct, and indirect effects. The independent variable was the intervention groups (MBSR intervention and TAU control groups). Meanwhile, the dependent variable was the difference in PTGI-SF score (primary outcome) between pre-treatment (T_0) and follow-up (T_2). The mediators were the secondary outcomes that exhibited statistically significant Pearson's correlation coefficients with the PTGI-SF score. PROCESS was used to validate the mediating effects of EA, optimism, and hope on the relationship between MBSR and PTGI-SF. Finally, bootstrapping confirmed the direct and indirect effects. Statistical significance was set at $p < .05$ and using a two-tailed approach.

3. Results

3.1. Sample characteristics

Figure 1 summarizes the recruitment, enrolment, allocation, follow-up, and analysis processes. Initially, 223 subjects were approached by the research assistant for recruitment. Of these, 100 subjects were excluded. A total of 123 subjects were screened for eligibility, but 33 subjects failed to meet the criteria, and 10 refused to participate. Thus, 80 participants were enrolled and randomized into the MBSR group ($n = 40$) and the TAU control group ($n = 40$) at T_0. Upon follow-up at T_1 and T_2, one participant in the TAU control group did not complete up to the T_1 assessment (missed assessment at T_1 and T_2), while another participant missed only the T_2 assessment. All participants in the MBSR group completed at least up to the T_1 assessment. The dropout participants were unlikely to introduce bias in the treatment effect analysis, as the number of dropouts was small ($\leq$ 5% of total participants) (Rose et al., 2023).

All participants in the MBSR group received five or six MBSR sessions, except for two participants (5%) who attended only four sessions. Three participants (7.5%) attended less than five sessions in the TAU group. No adverse effects or harm were reported during the RCT.

Table 1 presents the sociodemographic and clinical characteristics for both groups. No significant differences in sociodemographic or clinical characteristics were noted between the MBSR and TAU control groups, except for ethnicity ($p = .008$).

3.2. Primary outcome findings

Initially, in the mixed linear model of the total PTGI-SF score, after adjusting for age, the main effects of time [$F(2, 100) = 6.898$, $p = .002$] and the interaction between group and time [$F(2, 100) = 3.616$, $p = .030$] were statistically significant. However, the main effect of group was not statistically significant ($p = .095$). After adjusting for age and the baseline total PTGI-SF score, the main effect of time ($p = .956$), group ($p = .537$), and interaction between time and group ($p = .609$) were not statistically significant.

The post-hoc comparison of the total PTGI-SF, total LOT-R, total DHS, and total AAQ-II scores between the MBSR and TAU control groups at each time points (between-subject comparison) according to ITT analysis are presented in Table 2. The post-hoc comparison of changes in the total PTGI-SF, total LOT-R, total DHS, and total AAQ-II scores across time points for the MBSR and TAU control groups (within-subject comparison) according to ITT analysis are summarized in Table 3. The between-subject comparison revealed that the mean total PTGI-SF scores of the MBSR group was significantly lower than the TAU group ($p = .003$) at pre-intervention or baseline assessment (T_0). However, the mean difference between MBSR and TAU groups were not statistically significant at T_1 (post-intervention) ($p = .731$) and T_2 (follow-up) ($p = .439$). Initially, the within-subject comparison in the MBSR group revealed a significant increase in the total PTGI-SF score from T_0 to T_1 ($p < .001$) with a medium effect size ($d = 0.538$). Nevertheless, there was no further increase in the total PTGI-SF score from T_1 to T_2 ($p = .419$) in the MBSR group. While in the TAU group, there was no significant change in the total PTGI-SF scores from T_0 to T_1 ($p = .421$) and from T_1 to T_2 ($p = .756$).

Sensitivity analysis according to PP analysis reported similar findings, in which initially, the main effects of time ($p = .001$) and the interaction between group and time ($p = .046$) were statistically significant. However, the main effect of group was not statistically significant ($p = .276$). After adjusting for age and the baseline total PTGI-SF score, the main effects of time ($p = .730$), group ($p = .440$), and the interaction between time and group ($p = .905$) were not statistically significant. The between-subject post-hoc comparison in PP analysis also reported similar findings to ITT analysis, in which the mean total PTGI-SF scores of the MBSR group was significantly lower than the TAU group ($p = .034$) at pre-intervention (T_0). Nonetheless, the mean difference between MBSR and TAU groups were not statistically significant at T_1 (post-intervention) ($p = .449$) and T_2 (follow-up) ($p = .508$). Similar findings were also reported in the post-hoc within-subject comparison, as significant increase in total PTGI-SF was reported from T_0 to T_1 ($p < .001$), with no further increase in the total PTGI-SF score from T_1 to T_2 ($p = .739$). No

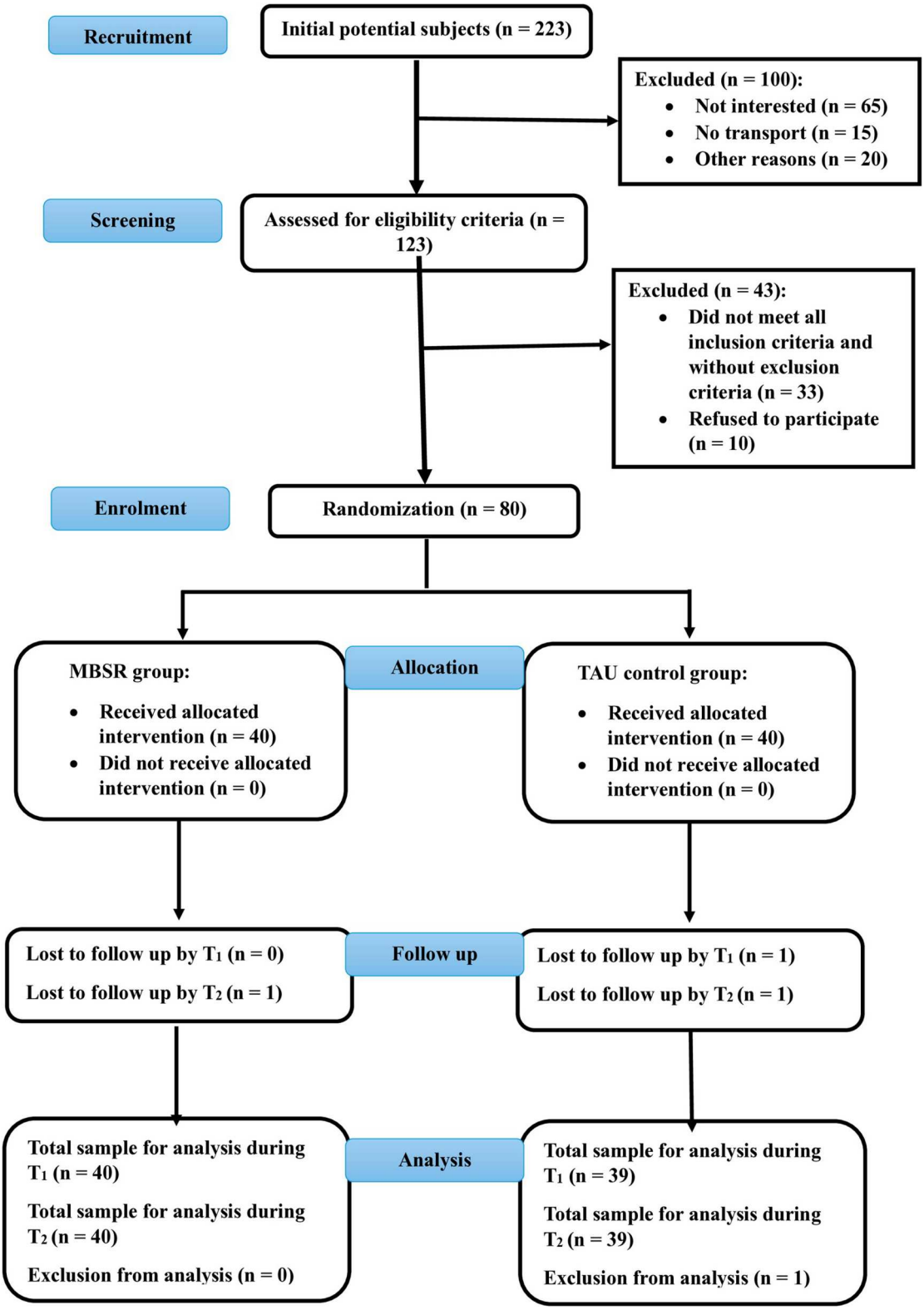

Figure 1. CONSORT flowchart indicating recruitment, screening, enrolment, randomization, and follow-up of participants in this study.

significant changes in total PTGI-SF score across time points was also reported in the TAU group in PP analysis. The post-hoc between-group comparison at each time point according to the PP analysis are summarized in Table 4. The post-hoc within-group comparison across time points according to the PP analysis are presented in Table 5.

3.3. Secondary outcome findings

Regarding hope, initially, there was significant main effects of time [$F(1, 103) = 10.668$, $p < .001$], group [$F(1, 79) = 20.887$, $p < .001$], and interaction between group and time [$F(1, 103) = 5.533$, $p = .005$] after adjusting for age. Then, similarly, there was significant

Table 1. The socio-demographic and clinical characteristics of the participants.

Variables	Number of participants (*n*)		Percentage (%)		*p*-value
	MBSR group	Control group	MBSR group	control group	
Age					
18–25 years	1	5	2.5	12.5	
26–45 years	16	14	40	35	
46–65 years	22	15	55	37.5	
>65 years	1	6	2.5	15	.060[a]
Gender					
Male	18	15	45	37.5	.650[b]
Female	22	25	55	62.5	
Ethnicity					
Malays	27	33	67.5	82.5	
Chinese	11	6	27.5	15	
Indians	2	1	5	2.5	.008[a]
Monthly household income					
<RM 4500	25	32	62.5	80	
RM 4500–RM 11,000	13	7	32.5	17.5	
>RM 11,000	2	1	5	2.5	.240[a]
Marital status					
Married	32	32	80	80	
Single/widow/ widower/divorce/ separated	8	8	20	20	1.000[b]
Education status					
Primary education or below	1	1	2.5	2.5	
Up to secondary education	16	11	40	27.5	
Tertiary education and above	23	28	57.5	70	.084[a]
Types of cancer					
NPC	19	15	47.5	37.5	
Oral Cancer	9	10	22.5	25	
Tongue Cancer	8	9	20	22.5	
Others	4	6	10	15	.822[a]
Stage of cancer					
Stage 1	1	2	2.5	5	
Stage 2	10	12	25	30	
Stage 3	13	13	32.5	32.5	
Stage 4	16	13	40	32.5	.830[a]
Duration since diagnosis					
New case	12	12	30	30	
1–6 months	28	28	70	70	1.000[b]
Subject recruitment site					
AMDI	15	16	37.5	40.0	
HUSM	10	11	25.0	27.5	
UKMMC	15	13	37.5	32.5	.921[b]

Note. Statistical significance at $p < 0.05$,* = mean, # = standard deviation, [a] = Fisher exact test, [b] = Pearson's chi square test, AMDI = Advanced Medical and Dental Institute, HUSM = Hospital Universiti Sains Malaysia, UKMMC = Universiti Kebangsaan Malaysia Medical Centre.

main effects of time [$F(1, 78) = 14.531$, $p < .001$], group [$F(1, 79) = 28.061$, $p < .001$], and interaction between group and time [$F(1, 78) = 6.941$, $p = .010$] after adjusting for age and baseline total DHS score.

The post-hoc between-subject comparison demonstrated that the DHS score was significantly higher in the MBSR group than the TAU group at pre-intervention (T_0) ($p = .006$) with a medium effect size ($d = 0.565$). The mean difference of the total DHS score between MBSR and TAU further increased at post-intervention (T_1) ($p < .001$) with a medium effect size ($d = 0.738$) and at follow-up (T_2) ($p < .001$) with a large effect size ($d = 1.573$). Meanwhile, the post-hoc within-subject comparison indicated found no significant change in the total DHS score in the MBSR group from T_0 to T_1 ($p = .677$), but the degree of hope significantly increased from T_1 to T_2 ($p < .001$) with a medium effect size ($d = 0.742$). Conversely, there was no significant change in the total DHS score in the TAU group from T_0 to T_1 ($p = .601$) and from T_1 to T_2 ($p = .537$) (Tables 2 and 3).

Sensitivity analysis according to PP analysis for the total DHS score also reported similar findings to ITT analysis, in which initially, there were significant effects of time ($p < .001$), group ($p < .001$), and the interaction between group and time ($p = .003$). After adjusting for age and baseline total DHS score, the effects of time ($p < .001$), group ($p < .001$) and interaction between time and group ($p = .019$) remained statistically significant. The post-hoc between-subject comparison in the PP analysis obtained similar results to those in ITT analysis, in which the MBSR group had a significantly higher total DHS score than the TAU group at post-intervention (T1) ($p = .011$) and at follow-up (T_2) ($p < .001$), except in T_0, where in PP analysis, there was no significant difference in the total DHS score between the MBSR and TAU groups ($p = .098$). Additionally, the post-hoc within-subject comparison in PP analysis found no significant change in the total DHS score in the MBSR group from T_0 to T_1 ($p = .633$), but the degree of hope significantly increased from T_1 to T_2 ($p < .001$). No significant change in the total PTGI-SF score was documented in the TAU group across time in PP analysis, in line with the results of ITT analysis (Table 4 and 5).

Initially, as for the degree of optimism, the mixed linear model analysis of the total LOT-R score according to ITT analysis reported a significant main effects of time [$F(1, 152) = 21.971$, $p < .001$], group [$F(1, 80) = 11.167$, $p = .001$] and the interaction between group and time [$F(1, 152) = 9.522$, $p < .001$] after adjusting for age. Similarly, the main effects of time [$F(1, 77) = 7.420$, $p = .008$], group [$F(1, 78) = 21.674$, $p < .001$], and interaction between group and time [$F(2, 77) = 25.939$, $p < 0.001$] were statistically significant after adjusting for age and baseline total LOT-R score.

The post-hoc between-subject comparison reported no difference in the total LOT-R score between the MBSR and TAU groups at pre-intervention ($p = .129$). However, the total LOT-R score of the MBSR group was significantly higher than the TAU group at post-intervention ($p = .005$) with a medium effect size ($d = 0.656$) and at follow-up ($p < .001$) with a large effect size ($d = 1.365$). The post-hoc within-subject comparison indicated that there was a significant increase in the total LOT-R score in the MBSR group from T_0 to T_1 ($p < .001$) with a medium effect size ($d = 0.563$). Then, the total LOT-R score continued to increase from T_1 to T_2 ($p < .001$) with a medium effect size ($d = 0.630$). Conversely, in the TAU group, there was a significant

Table 2. Post-hoc comparison of the of the total PTGI-SF, DHS, LOT-R and AAQ-II score between the MBSR and TAU control groups in each time points (T_0, T_1 and T_2) according to intention-to-treat analysis.

Outcome	Time point	MBSR group (mean/SD)	TAU group (mean/SD)	Mean difference (95% CI)	Standard error	*p*-value	Cohen's *d*
PTGI-SF	Baseline	29.9 (12.1), *n* = 40	37.8 (9.3), *n* = 40	−6.932 (−10.543 to − 2.121)	2.130	.003	0.731
	Immediate posttreatment	36.7 (8.9), *n* = 40	36.1 (9.5), *n* = 39	0.617 (−2.928–4.163)	1.789	.731	0.065
	12 weeks follow-up	37.1 (5.5), *n* = 40	35.7 (9.2), *n* = 39	1.399 (−2.167–4.966)	1.800	.439	0.184
LOT-R	Baseline	17.0 (3.4), *n* = 40	15.8 (3.3), *n* = 40	1.289 (−0.321–2.498	0.712	.129	0.353
	Immediate posttreatment	18.9 (2.9), *n* = 40	16.9 (3.2), *n* = 39	1.960 (0.613–3.307)	0.678	.005	0.656
	12 weeks follow-up	20.5 (2.5), *n* = 40	16.5 (3.3), *n* = 39	4.070 (2.717–5.423)	0.682	<.001	1.365
DHS	Baseline	26.0 (4.8), *n* = 40	23.4 (4.3), *n* = 40	2.638 (0.781–4.494)	0.938	.006	0.565
	Immediate posttreatment	26.2 (4.0), *n* = 40	22.9 (4.9), *n* = 39	3.280 (1.499–5.062)	0.899	<.001	0.738
	12 weeks follow-up	28.7 (2.6), *n* = 40	23.4 (4.0), *n* = 39	5.343 (3.546–7.139)	0.907	<.001	1.573
AAQ-II	Baseline	17.7 (8.5), *n* = 40	25.3 (11.9), *n* = 40	−7.612 (−9.581 to − 0.842)	2.203	.020	−0.737
	Immediate posttreatment	14.6 (4.4), *n* = 40	23.8 (12.3), *n* = 39	−9.255 (−13.657 to − 4.854)	2.214	<.001	−0.996
	12 weeks follow-up	14.4 (4.4), *n* = 40	24.2 (12.1), *n* = 39	−9.752 (−14.165 to − 5.339)	2.221	<.001	−1.077

Note. Statistical significance at $p < 0.05$, SD = standard deviation, *n* = sample size, $T_1 = 6$ weeks after intervention commenced (immediately after completion of intervention), $T_2 = 12$ weeks after completion of intervention, MBSR = mindfulness based stress reduction, TAU = treatment-as-usual controls.

increase in the total LOT-R score from T_0 to T_1 ($p = .009$) with a small effect size ($d = 0.333$), but no further significant change in the total LOT-R score from T_1 to T_2 ($p = .100$) (Tables 2 and 3).

Table 3. The post-hoc comparison in the PTGI-SF, DHS, LOT-R and AAQ-II scores across time point in the MBSR and the TAU control groups according to intention-to-treat analysis.

Intervention group	Mean difference between time points	Standard error	*p*-value	Effect size (Cohen's *d*)
PTGI-SF				
MBSR	T_0 to T_1: 5.650 (3.638–7.662)	1.145	<.001	0.538
	T_1 to T_2: 0.698 (−1.371–2.768)	0.864	.419	0.054
TAU	T_1 to T_2: − 1.497 (−3.500 to − 0.495)	0.312	.421	−0.181
	T_0 to T_2: − 0.836 (−0.835 to − 2.836)	0.235	.756	−0.043
Hope Scale				
MBSR	T_0 to T_1: 0.225 (−0.913–1.363)	0.296	.677	0.159
	T_1 to T_2: 2.524 (1.676–3.373)	0.340	<.001	0.735
TAU	T_0 to T_1: _ 0.361 (−2.062–1.340)	0.686	.601	−0.156
	T_1 to T_2: 0.361 (−1.279–2.136)	0.689	.537	0.111
AAQ-II				
MBSR	T_0 to T_1: − 3.123 (−5.781 to − 1.069)	0.919	<.001	−0.404
	T_1 to T_2: − 0.200 (−2.647–2.426)	0.756	.951	−0.095
TAU	T_0 to T_1: − 1.393 (−4.939–2.153)	1.416	.449	−0.124
	T_1 to T_2: 0.743 (−1.696–3.181)	0.971	.449	0.033
LOT-R				
MBSR	T_0 to T_1: 1.825 (0.907–2.743)	0.381	<.001	0.563
	T_1 to T_2: 1.650 (0.829–2.470)	0.328	<.001	0.630
TAU	T_0 to T_1: 1.201 (0.103–2.300)	0.439	.009	0.333
	T_1 to T_2: − 0.460 (−1.097–0.177)	0.252	.132	−0.121

Note. Statistical significance at $p < 0.05$, $T_1 = 6$ weeks after intervention commenced (immediately after completion of intervention), $T_2 = 12$ weeks after completion of intervention, MBSR = mindfulness based stress reduction, TAU = treatment-as-usual controls.

Sensitivity analysis according to PP analysis for the total LOT-R score also reported similar findings as ITT analysis, in which initially, there were significant effects of time ($p < .001$), group ($p < .001$), and interaction between group and time ($p < .001$). After adjusting for age and baseline total DHS score, the effects of time ($p < .004$), group ($p < .001$) and interaction between time and group ($p < .001$) remained statistically significant. The post-hoc between-subject comparison in the PP analysis was also similar to that in ITT analysis, in which there was no difference in the total LOT-R score between the MBSR and TAU groups at T_0 ($p = .125$). Then, the MBSR group had a significantly higher total LOT-R score than the TAU group at post-intervention (T_1) ($p = .009$) and follow-up (T_2) ($p < .001$). The post-hoc within-subject comparison in PP analysis found that the total LOT-R score significantly increased from T_0 to T_1 ($p < .001$) and T_1 to T_2 ($p < .001$). No significant change in the total LOT-R score was documented in the TAU group across time in PP analysis similar to ITT analysis (Table 4 and 5).

Initially, regarding the EA degree, the mixed linear model analysis of the total AAQ-II score according to ITT analysis reported that the main effects of group [$F(1, 80) = 14.109$, $p < .001$], time [$F(2, 103) = 14.742$, $p < .001$] and interaction between group and time [$F(2, 103) = 4.691$, $p = .011$] were statistically significant after adjusting for age. After adjusting for age and the baseline AAQ-II score, the main effect of group was statistically significant [$F(1, 79) = 19.381$, $p < .001$]. However, the main effects of time ($p = .792$) and the interaction between time and group ($p = .626$) were not statistically significant.

The between-subject comparison revealed that the mean difference of the total AAQ-II scores in the MBSR group was significantly lower than the TAU group at T_0 ($p = .020$) with a medium effect size ($d = -0.737$). Then, the total AAQ-II score continued to be significantly lower in the MBSR group at T_1

Table 4. Post-hoc comparison of the of the PTGI-SF, DHS, LOT-R and AAQ-II score between the MBSR and TAU control groups in each time points (T_0, T_1 and T_2) according to per protocol analysis.

Outcome	Time point	MBSR group (mean/SD)	TAU group (mean/SD)	Mean difference (95% CI)	Standard error	*p*-value	Cohen's *d*
PTGI-SF	Baseline	32.8 (12.2), *n* = 37	37.7 (9.7), *n* = 35	−4.933 (−9.497 to − 0.369)	2.306	.034	0.445
	Immediate posttreatment	37.4 (8.9), *n* = 37	36.0 (9.5), *n* = 35	1.434 (−2.309–5.177)	1.886	.449	0.152
	12 weeks follow-up	37.1 (5.5), *n* = 37	35.8 (9.2), *n* = 35	1.254 (−2.489–4.998)	1.886	.508	0.171
LOT-R	Baseline	17.0 (3.4), *n* = 37	15.8 (3.2), *n* = 35	1.176 (−0.330–2.681)	0.760	.125	0.364
	Immediate posttreatment	18.6 (2.9), *n* = 37	16.9 (3.2), *n* = 35	1.622 (0.417–2.826)	0.607	.009	0.557
	12 weeks follow-up	20.2 (2.5), *n* = 37	16.6 (3.3), *n* = 35	3.586 (2.382–4.791)	0.607	<.001	1.229
DHS	Baseline	25.2 (5.0), *n* = 37	23.5 (4.3), *n* = 35	1.674 (−0.314–3.663)	1.004	.098	0.362
	Immediate posttreatment	25.6 (4.0), *n* = 37	23.7 (4.9), *n* = 35	1.916 (0.441–3.390)	0.745	.011	0.403
	12 weeks follow-up	28.2 (2.6), *n* = 37	24.3 (4.0), *n* = 35	3.880 (2.406–5.355)	0.745	<.001	1.157
AAQ-II	Baseline	19.4 (8.4), *n* = 37	25.3 (11.8), *n* = 35	−5.882 (−10.538 to − 1.225)	2.346	.014	0.578
	Immediate posttreatment	16.5 (4.4), *n* = 37	23.6 (4.3), *n* = 35	−5.169 (−8.530 to − 1.808)	1.691	.003	−0.563
	12 weeks follow-up	16.5 (4.4), *n* = 37	24.0 (4.5), *n* = 35	−5.509 (−8.869 to − 2.148)	1.691	.002	−0.604

Note. Statistical significance at $p < 0.05$, SD = standard deviation, *n* = sample size, $T_1 = 6$ weeks after intervention commenced (immediately after completion of intervention), $T_2 = 12$ weeks after completion of intervention, MBSR = mindfulness based stress reduction, TAU = treatment-as-usual controls.

($p < .001$) with a large effect size ($d = -0.996$) and at T_2 ($p < .001$) with an almost similar large effect size ($d = -1.077$). Initially, the within-subject comparison in the MBSR group revealed a significant decrease in the total AAQ-II score from T_0 to T_1 ($p < .001$) with a small effect size ($d = -0.404$). However, there was no further reduction in the total PTGI-SF score from T_1 to T_2 ($p = .951$) in the MBSR group. In the TAU group, there was no significant change in the total PTGI-SF scores from T_0 to T_1 ($p = .449$) and from T_1 to T_2 ($p = .449$) (Tables 2 and 3).

Table 5. The post-hoc comparison in the PTGI-SF, HS, LOT-R and AAQ-II scores across time points in the MBSR and the TAU control groups according to per protocol analysis.

Intervention group	Mean difference between time points	Standard error	*p*-value	Effect size (Cohen's *d*)
PTGI-SF				
MBSR	T_0 to T_1: 5.649 (2.499–8.799)	1.300	<.001	0.431
	T_1 to T_2: − 0.351 (−2.448–1.745)	1.052	.739	−0.041
TAU	T_0 to T_1: 1.429 (−1.810–4.667)	1.337	.861	0.177
	T_1 to T_2: − 0.171 (−3.410–3.067)	1.081	1.000	−0.021
Hope Scale				
MBSR	T_0 to T_1: 0.703 (−0.653–2.058)	0.559	.633	0.088
	T_1 to T_2: 2.622 (1.485–3.759)	0.570	<.001	0.772
TAU	T_0 to T_1: _ 0.686 (−2.080–0.708)	0.575	.706	−0.043
	T_1 to T_2: 0.657 (−0.512–1.826)	0.586	.266	0.134
AAQ-II				
MBSR	T_0 to T_1: − 5.108 (−7.633 to − 2.583)	1.041	<0.001	−0.432
	T_1 to T_2: − 0.054 (−1.554–1.446)	0.753	.943	0.000
TAU	T_0 to T_1: − 1.657 (−4.254–0.939)	1.070	.372	−0.191
	T_1 to T_2: 0.286 (−1.257–1.828)	0.774	1.000	0.091
LOT-R				
MBSR	T_0 to T_1: 1.919 (0.931–2.907)	0.408	<.001	0.506
	T_1 to T_2: 1.622 (1.023–2.221)	0.301	<.001	0.590
TAU	T_0 to T_1: 0.800 (−0.216–1.816)	0.419	.175	0.344
	T_1 to T_2: − 0.343 (−0.959–0.273)	0.309	1.000	−0.092

Note. Statistical significance at $p < 0.05$, $T_1 = 6$ weeks after intervention commenced (immediately after completion of intervention), $T_2 = 12$ weeks after completion of intervention, MBSR = mindfulness based stress reduction, TAU = treatment-as-usual controls.

Sensitivity analysis according to PP analysis reported similar findings as ITT analysis, in which initially for the total AAQ-II score, the main effects of time ($p < .001$), group ($p < .001$), and the interaction between group and time ($p = .036$) were statistically significant. After adjusting for the age and baseline total AAQ-II score, the main effect of group was statistically significant ($p = .001$), whereas the main effects of time ($p = .831$) and interaction between time and group ($p = .754$) were not statistically significant. The between-subject post-hoc comparison in PP analysis also reported similar findings to ITT analysis in which the mean total AAQ-II score of the MBSR group was significantly lower than the TAU group ($p = .014$) at pre-intervention, post-intervention ($p = .003$), and follow-up ($p = .002$). PP analysis in the post-hoc within-subject comparison reported similar results to ITT analysis. Specifically, it reported significant increase in total AAQ-II score from T_0 to T_1 ($p < .001$), but there was no further increase in the total AAQ-II score from T_1 to T_2 ($p = .943$). No significant changes in total AAQ-II score across time points was also reported in the TAU group (Tables 4 and 5).

3.4. Mediation effect of hope, optimism and experiential avoidance on the relationship between MBSR and total PTGI-SF

Pearson's correlation coefficients between hope, optimism, EA, and PTG are presented in Supplementary Table 2. Hope, optimism, and PTG were significantly positively correlated with each other. Meanwhile, EA was significantly inversely correlated with hope, optimism, and PTG. Hence, all the above variables were entered into the mediation analysis.

The mediation effects of EA, optimism, and hope on the relationship between MBSR and the degree of PTG are presented in Table 6. Figure 2 illustrates the mediation effects of EA, optimism, and hope on the relationship between MBSR and PTG. Mediation analysis revealed a significant effect of MBSR on EA, in which MBSR significantly decreased EA (path a': B = −4.000, 95% CI = −7.059 to − 0.941, $p < .001$). EA also exerted a significant effect on PTG, whereby a decrease in EA significantly increased PTG (path b': B = 0.415, 95% CI = 0.090–0.739, $p = .013$). MBSR also significantly increased hope (path a: B = 2.900, 95% CI = 1.256–4.544, $p < .001$), but hope did not exert a significant effect on PTG (path b: $p = .591$). Additionally, MBSR significantly increased optimism (path a'': B = 2.700, 95% CI = 1.262–4.138, $p < .001$). However, optimism did not significantly increase PTG (path b'': $p = .858$). The total indirect effect of hope, optimism, and EA (a*b + a'*b' + a''*b'') on the relationship between MBSR and PTG was not significant (B = −1.004, 95% CI = −4.143–1.641). However, the indirect effect of EA on the relationship between MBSR and PTG was significant (B = −1.658, 95% CI = −3.454 to − 0.146), whereas the indirect effects of hope (B = 0.484, 95% CI = −1.760–2.127) and optimism (B = 0.170, 95% CI = −1.563–2.074) were not statistically significant. The direct effect of MBSR on PTG was significant, with MBSR significantly increasing PTG (path c': B = 6.579, 95% CI = 1.714–11.443, $p = .009$), and the total effect of MBSR on PTG was also significant (path c: B = 5.575, 95% CI = 1.215–9.935, $p = .013$). Hence, EA exerted a partial mediation effect on the relationship between MBSR and PTG, but not on hope and optimism.

4. Discussion

We found that MBSR significantly enhanced optimism and hope, even after adjusting the mixed linear model for age and baseline total LOT-R and DHS scores. Conversely, PTG significantly increased and EA significantly decreased in the MBSR group only from pre-intervention to immediate post-intervention (T_0 to T_1). No further changes in PTG and EA across time measurements were noted. PTG, hope, optimism, and EA exhibited no significant changes across time measurements in the TAU control group. Moreover, EA exerted a partial mediation effect on the relationship between MBSR and the degree of PTG among HNC participants. However, hope and optimism did not exert any mediation effect on the relationship between MBSR and PTG.

Intriguingly, our study demonstrated that MBSR did not immediately and drastically enhance hope at post-intervention, but rather increased it at follow-up (12 weeks after completion of the MBSR intervention). This is because MBSR takes longer to increase hope by promoting treatment goals focused on improving QOL and physical well-being in HNC patients while failing to elevate hope immediately post-intervention as the hope for complete recovery wanes (Sanatani et al., 2008).

Further, MBSR enhances self-compassion and reduces self-criticism. Elevated self-compassion may facilitate optimism as a non-critical stance towards one's inadequacies and failures (Davis et al., 2024). As optimism is a motivational state in which one exhibits a greater tendency to positively perceive events in life, MBSR may enhance optimism among the HNC patients through increasing self-compassion and reducing self-criticism.

When cancer patients experience physical symptoms of cancer and the adverse effects of its treatment, this may induce trauma. The traumatic experience leads to the shattering of their presumptive views of self, others, and the surrounding world (Leong Abdullah et al., 2019). Theoretically, when administered to cancer patients, MBSR facilitates decentering and acceptance, which enables positive reappraisal of

Table 6. The mediation effect of psychological inflexibility, optimism and hope on the relationship between MBSR effect on PTG.

Mediators	Path	Coefficient	SE	*t*	*p*-value	Bootstrapping (LLCI to ULCI)
Hope	a	2.900	0.826	3.512	<.001	1.256 to 4.544
	b	0.167	0.310	0.540	.591	−0.450 to 0.784
	c	5.575	2.190	2.546	.013	1.215 to 9.935
	c′	6.579	2.442	2.694	.009	1.714 to 11.443
	a*b	0.484	0.935			−1.760 to 2.127
	a*b (Partially Standardized Indirect Effect)	0.048	0.096			−0.1665 to 0.2319
Experiential avoidance	a′	−4.000	1.537	−2.603	.011	−7.059 to −0.941
	b′	0.415	0.163	2.544	.013	0.090–0.739
	c	5.575	2.190	2.546	.013	1.215 to 9.935
	c′	6.579	2.442	2.694	.009	1.714 to 11.443
	a′*b′	−1.658	0.906			−3.454 to −0.146
	a′*b′(Partially Standardized Indirect Effect)	−0.164	0.085			−0.325 to −0.017
Optimism	a″	2.700	0.722	3.738	<.001	1.262 to 4.138
	b″	0.063	0.350	0.180	.858	−0.634 to 0.760
	c	5.575	2.190	2.546	.013	1.215 to 9.935
	c′	6.579	2.442	2.694	.009	1.714 to 11.443
	a″*b″	0.170	0.904			−1.563 to 2.074
	a″*b″ (Partially Standardized Indirect Effect)	0.017	0.090			−0.172 to 0.190

Note. Statistical significance at $p < .05$.

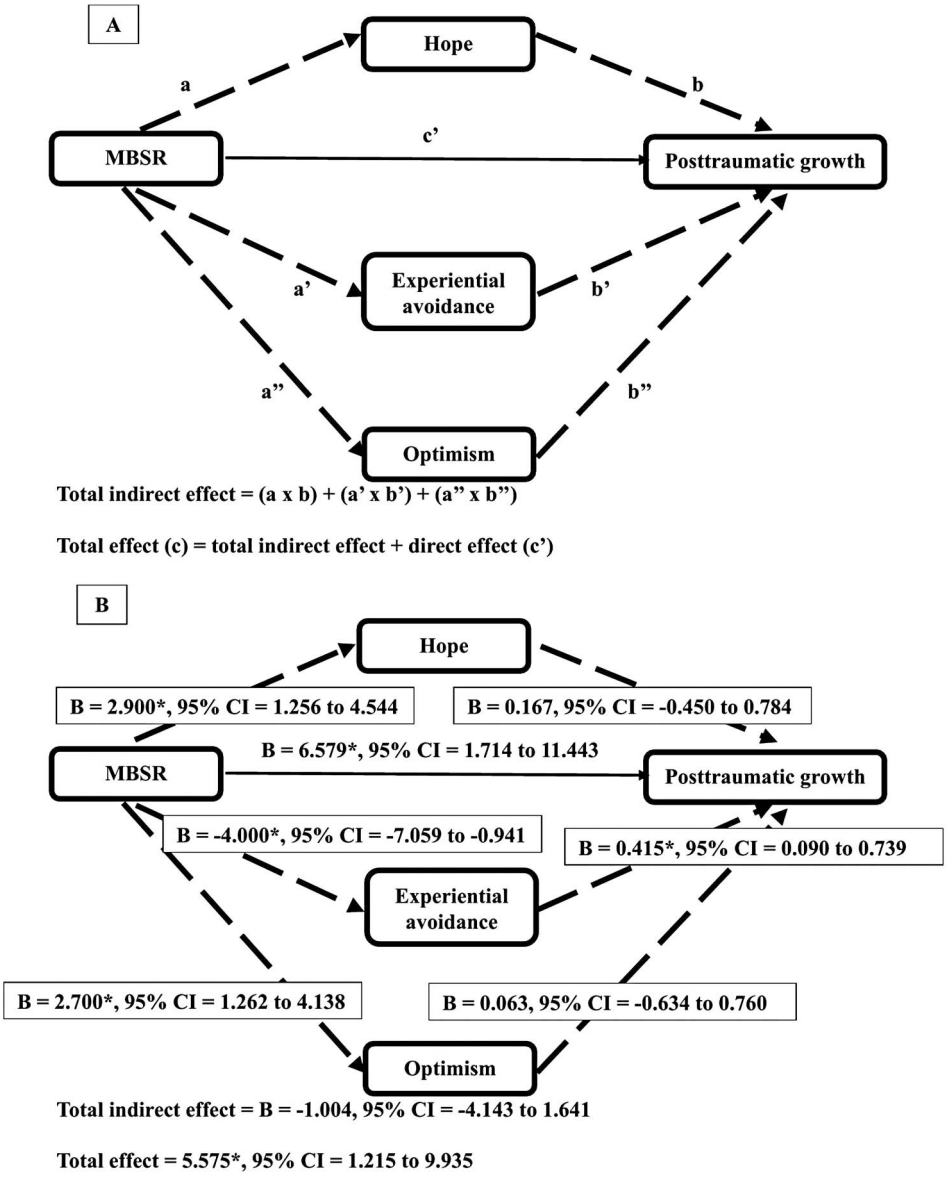

Figure 2. The mediation effect of experiential avoidance, optimism and hope on the relationship between MBSR effect on posttraumatic growth among the head and neck cancer participants in this study. Diagram A: a = effect of MBSR on experiential avoidance, b = effect of experiential avoidance on posttraumatic growth, a′ = effect of MBSR on hope, b′ = effect of hope on posttraumatic growth, c′ = direct effect of MBSR on posttraumatic growth, total indirect effect = a*b + a′*b′, total effect = direct effect + total indirect effect of experiential avoidance and hope. Diagram B: MBSR exerted a significant effect on experiential avoidance and experiential avoidance in turn also exerted a significant effect on posttraumatic growth. Although MBSR exerted a significant effect on hope, the latter did not significantly affect posttraumatic growth. Similarly, although MBSR exerted a significant effect on optimism, the latter did not contribute to any effect on posttraumatic growth. Hence, the sum of the indirect effect of experiential avoidance, optimism and hope on the relationship between MBSR and posttraumatic growth was not significant. However, since the total direct effect of MBSR onto posttraumatic growth was at B = 6.7762 (p = .003), while the total effect was at B = 5.5500 (p = .013), we concluded that experiential avoidance exerted a significant partial mediation effect on the relationship between MBSR and posttraumatic growth among the cancer patients in this study.

traumatic experiences (Lindsay & Creswell, 2017). However, MBSR was not effective in enhancing acceptance of living with cancer and the adverse effects of its treatment among HNC patients in this study. This could be due to the greater severity of physical complications specifically related to HNC and its treatment, as 72.5% of participants in the MBSR group had advanced cancer (stage 3 and 4). MBSR has been reported to exert greater effects on cancer patients at early stages of cancer (Lin et al., 2022; Patierno et al., 2023; Sharma et al., 2024). According to the Janus two-face model of PTG, when HNC patients are still in denial of being diagnosed with cancer and having to live with it and the adverse effects of its treatment, reappraisal of the traumatic event is avoided. Hence, there was only illusory PTG that developed initially but faded over time, while constructive PTG failed to develop through accommodation (Zoellner & Maercke, 2006). Additionally, the findings confirmed that six weekly MBSR sessions

are not sufficient to sustain a further increase in PTG over time compared with the conventional eight weekly MBSR sessions (Dong et al., 2024).

4.1. Mediation effect of experiential avoidance on the relationship between MBSR and PTG

The findings verified the partial mediation effect of decreasing the degree of EA on the role of MBSR in enhancing PTG among HNC patients. This is because MBSR facilitates acceptance (by reducing experiential avoidance) followed by positive reappraisal of the traumatic event of having cancer and the painful adverse effects of its treatment to allow a success (Nik Jaafar et al., 2021). Conversely, hope and optimism did not mediate the effect of MBSR on PTG, as increasing motivation and thoughts about strategies to achieve self-set goals after the diagnosis of cancer and elevating tendency to perceive outcomes in life in a positive manner might not be sufficient to drive successful search for meaning out of the traumatic event of living with cancer and the adverse effects of its treatment.

4.2. Limitations and strengths

This study had some limitations. First, this study did not assess treatment modalities and spousal support, which are known predictors of PTG in HNC patients (Nik Jaafar et al., 2022). Second, the gender distribution of the study sample in both MBSR and TAU control groups was not representative of the HNC population in Malaysia, as the sample in this study had a higher proportion of females. This may affect the generalizability of the findings. However, the other sociodemographic and clinical characteristics of the study sample were similar to the HNC population in Malaysia (National Cancer Registry of Malaysia, 2023). Third, the sample size was relatively small (39 participants in the MBSR group and 38 participants in the TAU group). However, the sample that completed all the time points in this study was still higher than the estimated sample size without inclusion of 20% dropouts, which was 37 subjects per group. Finally, the number of repeated assessments was small at only three time points (inclusive of baseline). Future studies should perform assessments at least four time points.

Nevertheless, this study is the first to report the effects of MBSR on PTG, optimism, hope, and EA among cancer patients in general, and HNC patients specifically. This study provides valuable evidence for important clinical implication. Conventionally, MBSR is delivered in 8 weekly sessions with each session lasting for 2–3 hours. However, this study highlights that 60-minute MBSR sessions for 6 weeks are also comparably efficacious, regarding their impacts on hope and optimism of cancer patients.

5. Conclusion

In conclusion, this appropriately powered RCT revealed that MBSR was efficacious to enhance the degree of positive psychological traits (e.g. optimism and hope) across time. However, the sustaining effects of enhancing PTG and alleviating EA across time measurements were not documented. Nevertheless, the decreasing degree of EA partially mediated the effect of MBSR on enhancing the level of PTG. Hence, MBSR can be recommended as part of the treatment regimen for HNC patients.

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Author contributions

Z.Z: project administration, formal analysis, data curation, investigation, funding acquisition, writing – the first draft, writing-review and editing. Q.Z: project administration, formal analysis, data curation, investigation, funding acquisition, writing-review and editing. P.L: conceptualization, methodology, supervision, validation, data curation, writing-review and editing. N.I.S: methodology, supervision, validation, data curation, writing-review and editing. N.R.N.J: conceptualization, supervision, validation, data curation, writing-review and editing. M.R.M.Y: conceptualization, supervision, data curation, writing-review and editing. M.F.I.L.B.A: conceptualization, methodology, project administration, supervision, validation, formal analysis, data curation, investigation, funding acquisition, writing – the first draft, writing-review and editing.

Disclosure statement

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Trial registration

This study was registered with the ClinicalTrials.gov, United States on March 16, 2021 (Trial registration number: NCT04800419).

Data availability statement

The data that support the findings of this study are available on request from the corresponding author (M.F.I.L.B.A).

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