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A randomized control trial of the effectiveness of online Mindfulness-Based Cancer recovery program on psychological well-being, caregiver burden and resilience in cancer patients' caregivers

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ABSTRACT

Background: Living with cancer patients causes a lot of psychological sufferings to their caregivers. Many caregivers lose their resilience and experience periods of mental distress during the long and tumultuous period of treatment. It seems that just as it is important to address the psychological problems of patients themselves, it is also important to help reduce the psychological suffering of caregivers. This study aims to apply online mindfulness-based cancer recovery (E-MBCR) program to improve psychological well-being, increase resilience and reduce caregivers' burden. *Method:* This is a clinical trial study. Fifty-three caregivers were recruited via purposeful sampling from three hospitals and were randomly divided into experimental (n=28) and control groups (n=25). The experimental group received a 9-week online format MBCR intervention. In order to examine the research variables, the Connor and Davidson resilience scale (CDRS), World Health Organization Well-Being Index (WHO-5), and Zarit Burden Interview (ZBI) were used. Both groups were assessed at three phase, baseline, post-test and three months follow-up. *Results:* The results of repeated measures analysis of variance showed that the treatment had improved the dependent variables in the experimental group. This effect was such that CDRS (F=19.55, P=0.00, η2=0.32) and WHO-5 (F=38.47, P=0.00, η2=0.48) increased and ZBI scores (F=41.31, P=0.00, η2=0.49) decreased. *Conclusion***:** E-MBCR can be an effective way to improve the psychological states, capacity to cope and quality of the inner world of cancer patients' caregivers and can significantly reduce the mental burden of living and caring of this population during this difficult time.

Keywords: Mindfulness-based Cancer Recovery Program, Caregivers, psychological well-being, Resilience, burden, psycho-oncology.

1. INTRODUCTION

Being a caregiver of a cancer patient is an extremely frustrating experience. Partners and families frequently struggle with the imposed unwanted tragedy and are under the pressure of providing support (Lund et al., 2015). Many evidence suggests that being a caregiver of a cancer patient is a highly emotionally and psychologically straining experience (Surbone et al., 2010). This means the cancer caregivers also suffer from many mental health complications and reduced psychological well-being [PSW] (Stenberg et al., 2010). In other words, cancer not only has adverse psychological effects on the patients' and survivors' lives (Herschbach et al., 2004; Wang et al., 2020; Maguire, 1985), but also on family members. This is because, during the long period, the mass of responsibilities and worries could truly deplete the psychological resources of caregivers and make them more susceptible to emotional difficulties (Tang et al., 2016). Many caregivers report heightened emotional problems such as anxiety, depression (Oechsle et al., 2013), poor sleep quality (Wong et al., 2020), fatigue (Jensen & Ishaan, 1991), and social isolation (van Roij et al., 2019) as well as social difficulties including financial issues, role strain (Govina et al., 2019) and caregiving burden [CB] leading to lower levels of quality of life [QoL] (Johansen et al., 2018).

Many caregivers feel crushed under the strain of responsibilities of their beloved illness such as providing limitless patient care, coordinating regular health care providers visits, taking care of medication, monitoring treatment process, provision of emotional support, and even preparing themselves with unpredictable death of dear ones (Kaziunas et al., 2013; Shin et al., 2018; Üzar-Özçetïn & Dursun, 2020), all of which add to their burden. CB is defined as potential, inherent stress, related to providing care felt on behalf of the caregivers (Geng et al., 2018). Although the caregiving process is regarded as a paralyzing and exhausting process, some caregivers thrive and demonstrate resilience (Cormio et al., 2014), which is described as a process of adaptation to adversity and effort to overcome it. The term resilience denotes to process of withstanding difficult events by developing the ability and power to recuperate from the experience and obtain positive meaningful outcomes (Deshields et al., 2016). The literature review show that resilience can positively influence caregivers' QoL (Hwang et al., 2018) and increase the probability of developing positive psychological outcomes (Pessotti et al., 2018; Higginson & Gao, 2008), as resilience is an internal psychological privilege helping to reduce emotional distress and facilitating the retainment of mental health (Hwang et al., 2018).

Despite many problems, caregivers are always expected to function optimally, adjust to changes and heighten their tolerance and resiliency in dealing with CB (Pessotti et al., 2018), however, unfortunately, despite the fact of being a valuable resource of providing support and the critical role they play in patients' recovery and illness management (Røen et al., 2018), they are not sufficiently equipped with skills aiming at ameliorating their global psychological health. The issue of PSW and CB and resilience could be more complicated during the Covid-19-time frame during which responsibilities and anxieties double for cancer patients and related caregivers (Akkuş et al., 2021).

Most caregivers are bare-handed and are faced with inadequate support and their significant role is unfairly hidden or overlooked while caregivers' psychological stance could truly influence the clinical and mental health of patients given patients' heavy reliance on them in managing the situation and receiving support (Chen et al., 2020). Thereby, equipping them with a multiple psychological skills that allow them to cope more powerfully with the stressful event is important for both themselves and patients' mentality, altogether emphasizing the entailment of interventions targeting this population group. Past endeavors have been made to provide psychosocial interventions for caregivers and show the acceptable effectiveness of education on psychological correlates (Northouse et al., 2014; Toseland et al., 1995). One of the psychological interventions that have recently gained considerable attention in oncology field on caregivers is mindfulness-based interventions.

Studies have supported the effectiveness of mindfulness-based stress reduction (MBSR) and its cancer-specific extension: mindfulness cancer recovery program (MBCR) in alleviating many caregivers' problems (Kubo et al., 2020; Atreya et al., 2018; Belgacem et al., 2013). Nonetheless, the majority of the research attentions have been directed toward patients, and caregivers are mostly neglected in comparison with patients. Furthermore, given the social-distancing constraints brought on by Covid- 19 on all peoples' lives including caregivers, many families and partners were under double pressure regarding the limitation of access to psychological treatments and interventions. In this respect, the internet could have an additive value since it offers opportunities for caregivers to have access to mental health professionals at flexible times, that is why the present study aims to use the internet-based mindfulness-based cancer recovery program (E-MBCR) on cancer caregivers, as they are highly occupied with caring

responsibilities and allocate less time for their own mental and personal health. This study is mainly focused on CB, Caregivers' PSW, and resiliency.

2. MATERIAL AND METHOD

Study design

The present study is a pre-test, post-test, and follow-up clinical trial in two control and experimental groups which was performed on cancer patients' caregivers.

Procedures

The study began from May 2021 to December 2021. The data gathering and research setting included three hospitals in Tehran, Iran. In the first step, the oncologist informed the caregivers of the existence of a research project, its nature and process. Then, those who were willing to be in the research project were assessed for the inclusion and exclusion criteria by the research team. In the next stage, after obtaining the written consent, those caregivers who met the conditions for participating in the research were randomly allocated into experimental and control groups. A pre-test evaluation was performed for both groups and then a 9-session online MBCR intervention was implemented in the MBCR group in 5-individauals group's format, while those in the control group went through one debriefing session on psychological issues and life problems cancer accompanied by the disease. After the treatment sessions (9 weeks), post-test assessment, and after three months follow-up evaluations were performed for both groups (Figure 1).

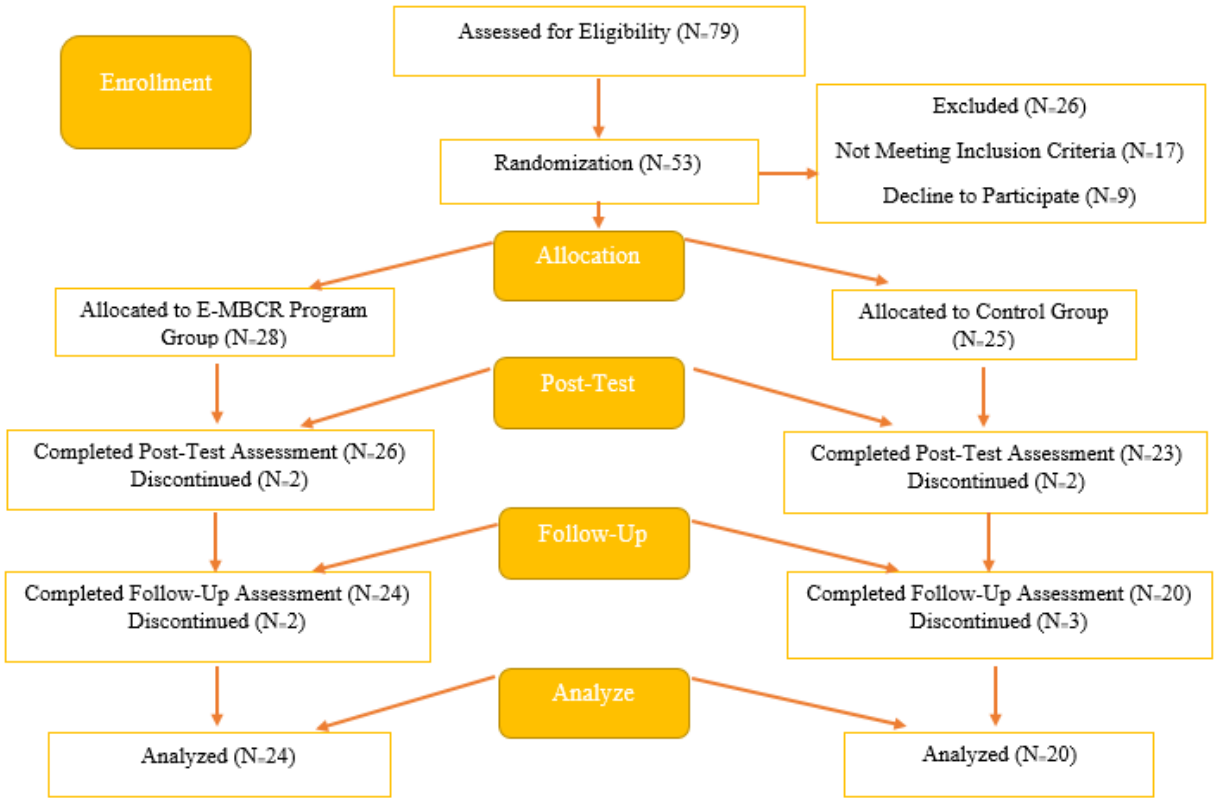

Figure 1 Flow chart of the study procedure

Sampling

The sampling method in this research was purposeful. A total of fifty-three participants were randomly divided into experimental (N=28) and control (N=25) groups. Randomization was performed using a draw lot.

Eligibility

Inclusion criteria are as follows: (1) willingness to participate in research, (2) being a family member, friend, or close relative involved with caring for the cancer patient who is currently receiving treatment, (3) being at least 18 years old, (4) acceptable

reading and writing ability, (5) having access to PC or smartphone and high-speed internet, (6) being recognized and suggested as a companion and caregiver by the patient, (7) No history of participation in any yoga or meditation course during the E-MBCR program or the past 6 months.

Exclusion criteria include (1) caregivers receiving a regular psychological intervention, (2) concomitant use of psychiatric medication, (3) having severe mental problems, (4) an unpleasant physical illness that prevents the caregiver from participating in research, such as hearing problems, (5) being absent for more than two sessions in research intervention sessions.

Ethical Standards

In all stages of this research, the ethical standards of working with human were met based on the Helsinki Ethical Approval. All participants were thoroughly being explained about the study goal and process and all signed written consent to participate. It should be noted that the ethical approval of this research was received from the Research Ethics Committee of Shahid Beheshti University of Medical Sciences (approval code: IR.SBMU.MSP.REC.1399.542).

Intervention

In this study, we used the MBCR program created by Carlson et al., (2019) which is a modified version of mindfulness-based stress reduction program [MBSR] developed by Kabat-zinn (2003), specifically applied on the cancer patients. The online version of this treatment was used for two reasons. First, for the welfare of caregivers: the online course could aptly save their time, and second, the Covid-19 social-distancing protocols entailed avoidance of any meeting, thus holding online group sessions would be beneficial. The intervention program encompassed nine 60 to 90 minutes group format sessions. The head of research team afforded the charge of internet access for all participants. In addition, a package of essential tools including clips, recordings, manuals and workbooks were delivered to participants. Avoid forgetting sessions; staff members were responsible for coordinating the sessions such that they used to remind the participants one day before the treatment sessions.

In each session, three sections were discussed and reviewed: (1) last week's experiences, (2) training, and (3) practice. As the name implies, this intervention is a kind of lifestyle in which participants are trained to be open and receptive to everyday events and deliberately choose to face the reality of each moment as it is, without engaging in a judgmental attitude. The session-by-session instructions for this intervention can be discerned in Table 1.

Table 1 session by session protocol of E-MBCR

Week	Content	Techniques learned, exercises and activities
Week 1:	Introducing the program and getting familiarized with orientations	Principles and concept of mindfulness are explained
Week 2:	Mindfulness	Participants pay attention to pattern of their breath and scan body and breath,
Week 3:	Mindfulness attitude is created	Mindfulness frame is taught and participants are encouraged toward awareness of pleasant moments
Week 4:	Gaining wisdom on Mind-body	"Mind-body" connection is focused. Particpants are directed toward respond instead of instantly reacting to life events
Week 5:	Focusing on the balance of autonomic nervous system	Some breathing techniques are practiced for balancing the nervous system, also some sleeping techniques are taught
Week 6:	Coping mindfully	Participants learn about the way our thoughts, beliefs, and personal narratives shape our experience of stress
Week 7:	Beneficial states of heart and mind is fostered	Meditation is practiced, imagination is cultivated and compassionate state for self and other is grown
Week 8:	expanding and deepening	Beyond the breath: awareness expansion
Week 9:	Moving into the world	The insights obtained are reviewed and the practices are integrated into day-to-day living

Measurements

Demographic information

The demographic information form includes questions focusing on information related to age, sex, education, marital status, number of months involved in caring responsibilities, and type of patient's cancer.

Psychological wellbeing (PSW)

The study employed the short questionnaire 5-item World Health Organization Well-Being Index (WHO-5) which encompasses 5 non-invasive and simple questions targeting the PSW of the individual. Respondents are asked to report their accordance with each statement on 6 point- likert scale considering the suitability of the scale's statements with their psychological condition during the recent 14 days. Each item score is from 0 to 5 (all of the times-not at all) (Topp et al., 2015). Favorable psychometric properties in different samples (a=0.87) (Awata et al., 2007) and Iranian populations (a=0.94) (Khosravi et al., 2015) has been shown for the scale.

Resilience

The Connor and Davidson resilience scales (CDRS) was used to measure the resilience of caregivers. It consists of 25 questions on a 5-point scale, and the options are graded by "not true" to "true nearly all the time". The total score is from 0 to 100, which is obtained from the sum of the scores of each item (Connor & Davidson, 2003). This scale has shown good validity and reliability in different populations (0.87 to 0.89) (Yu et al., 2011), and cancer patients (a=083) (Alarcón et al., 2020). The Cronbach's alpha of Persian version of this scale has been reported 0.83. The Cronbach's alpha 0.82 was obtained in our study.

Caregiving burden (CB)

Short form (12-item) of the Zarit Burden Interview (ZBI) was used to measure the CB. This scale is built on a 5-point scale with options ranging from never to almost always. The maximum and the minimum scores of a person are 48 and 0 respectively. Higher scores indicate greater suffering of CB (Zarit et al., 1980). This measurement has acceptable psychometric properties and its validity and reliability have been well proven (0.88) (Bédard et al., 2001), especially in cancer patients population (Galindo-Vazquez et al., 2015). The Persian version of the scale has been reported (0.77) (Rajabi-Mashhadi et al., 2015). The Cronbach's alpha was calculated 0.81 in this study.

Data analysis

For descriptive analysis of variables, mean and standard deviation were used. Repeated measure analysis of variance was used to compare the research groups. Bonferroni post-hoc test was used for pairwise comparison. Data were analyzed by SPSS version 25.

3. RESULTS

Of the 79 caregivers who were initially surveyed, 26 were regarded as excluded ones from the study because of not meeting the eligibility criteria or disinclination to participate in the research study, leaving 53 individuals to participate. Table 2 shows the demographic characteristics of participants.

Table 2 Demographic characteristics of Participants

	Variable	E-MBCR	control	P
		N (%)	N (%)	
Sex	Male	9 (32%)	9 (36%)	.741
	Female	19(68%)	16 (64%)	
Education	Diploma	6 (22%)	7 (28%)	.326
	Upper diploma	3 (10%)	5(20%)	
	Bachelor	13 (47%)	11(44%)	
	Master	4 (14%)	2 (8%)	
	Ph.D.	2 (7%)	----	
Marital status	Married	16 (57%)	17 (68%)	.472
	In relation	5 (18%)	4 (16%)	
	separated	6 (21%)	2 (8%)	
	widowed	1 (4%)	2 (8%)	

Relationship with patient	spouse	12 (43%)	9 (36%)	.381
	children	11 (39%)	12 (48%)	
	sibling	4 (14%)	4 (16%)	
	friend	1(4%)	-----	
type of cancer of the patient	Colon	8(29%)	10 (40%)	.254
	Rectum	5(17%)	6 (24%)	
	Stomach	7 (25%)	7 (28%)	
	Liver	8 (29%)	2 (8%)	
		Mean (SD)	Mean (SD)	
Age		42.27 (5.62)	46.51 (6.33)	0.124
Number of months involved in caring		14.16 (3.85)	16.34 (4.17)	0.271
E-MBCR: Internet-based Mindfulness-Based Cancer Recovery **Note: (P<0.05)**				

As you can see in Table 2, both groups are homogeneous in terms of research variables, and according to the independent chi-square and t-test, there is no significant difference between the groups in these variables. No significant difference was either observed in the baseline phase between the E-MBCR and control groups given the dependent variables of the study, namely resilience ($t_{(51)} = 0.41$, $p = 0.68$), PSW ($t_{(51)} = -0.34$, $p = 0.73$), and CB ($t_{(51)} = 0.33$, $p = 0.74$). The differences in scores of scales in three phases of treatment are shown in table 3.

Table 3 Means and Standard Deviations of Dependent Variables in 3 phases of the study

Variables	Condition	Pre-treatment Mean _(SD)	Post-treatment Mean _(SD)	Follow up Mean _(SD)
CDRS	E-MBCR	34.12 (9.81)	40.76 (11.38)	40.54 (10.89)
	Control	32.92 (9.46)	30.65 (10.22)	33.15 (8.73)
WHO-5	E-MBCR	10.14 (2.88)	14.11 (3.97)	14.16 (3.89)
	Control	10.40 (2.50)	10.47 (2.62)	10.80 (2.91)
ZBI	E-MBCR	35.39 (6.19)	29.03 (6.87)	28.29 (6.89)
	Control	34.80 (6.78)	35.17 (6.50)	35.55 (6.07)

E-MBCR: Internet-based mindfulness-Based Cancer Recovery
CDRS: Connor and Davidson resilience scales
WHO-5: 5-item World Health Organization Well-Being Index
ZBI: Zarit Burden Interview

As it is apparent in Table 3, there exist differences between the means of CDRS, WHO-5, and ZBI in the course of three phases of research treatment between two groups. However, for a more detailed and step-by-step analysis of the differences between the groups in different periods, repeated measures analysis of variance was used (Table 4). The pre-assumptions of this test were performed and the parametricity of the data was proved. the Kolmogorov-Smirnov test and box plots were examined (figure 1-3) to assess normality distribution [CDRS (Z=0.18 , P=0.14); WHO-5 (Z= 0.15, P=0.15); ZBI (Z= 0.11, P=0.20)], the Leven's test for homogeneity of variance [CDRS (F=0.8 , P=0.77); WHO-5(F=0.41, P=0.53); ZBI (F=0.02 , P=0.87)]; M-box test for homogeneity of covariance [CDRS (F=3.81 , P=0.6); WHO-5(F=0.88 , P=0.51); ZBI (F=1.35 , P=0.23)], and the Mauchly's sphericity test for checking sphericity assumption [CDRS (Mauchly's χ^2 =4.59, P=0.10); WHO-5(Mauchly's χ^2 =14.07 , P=0.001); ZBI (Mauchly's χ^2 =20.21 , P=0.000)]. Greenhouse–Geisser corrections are reported when the sphericity assumption is not met. To assess time and group main effects, the data were examined by 3 (time) × 2 (group). P-value < .05 was set in this study.

Table 4 Repeated Measure Analysis of Variance for Scores for dependent variables

Assessments	Statistical Indices		SS	df	MS	F	P Value	Eta square
*CDRS	Within group	Time	284.65	2	142.32	18.44	0.000	0.31
		Time*group	302.25	2	151.12	19.58	0.000	0.32
	Between group	Group	878.34	1	878.34	3.18	0.032	0.12
**WHO-5	Within group	Time	132.56	1.55	85.54	54.92	0.000	0.57
		Time*group	92.87	1.55	59.93	38.47	0.000	0.48
	Between group	Group	166.51	1	166.51	5.62	0.022	0.14
**ZBI	Within group	Time	309.17	1.44	214.74	40.71	0.000	0.49
		Time*group	313.72	1.44	217.89	41.31	0.000	0.49
	Between group	Group	656.19	1	656.19	5.33	0.026	0.13

***: with sphericity assumption**

****: with Greenhouse- Geisser Correction**

E-MBCR: Internet-based Mindfulness-Based Cancer Recovery

CDRS: Connor and Davidson resilience scales

WHO-5: 5-item World Health Organization Well-Being Index

ZBI: Zarit Burden Interview

Note: (P<0.05)

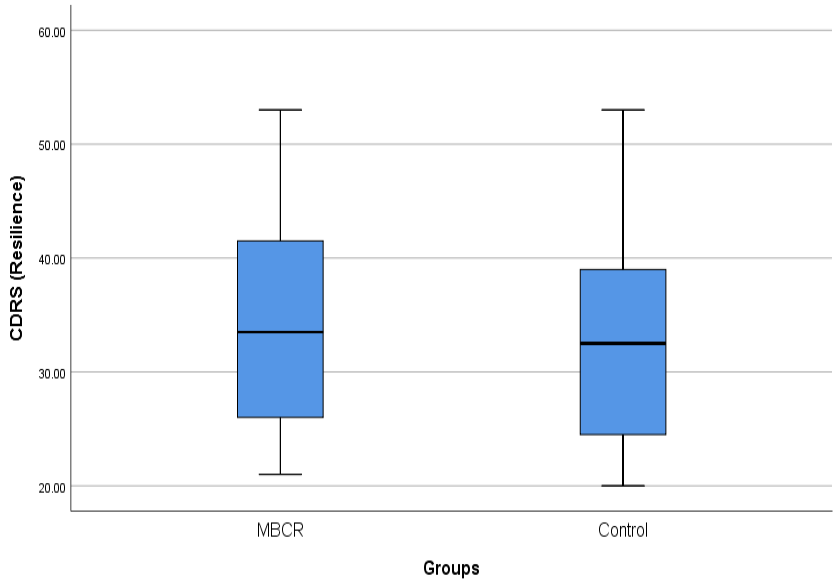

Figure 1 Box plot of normal distribution of CDRS scores

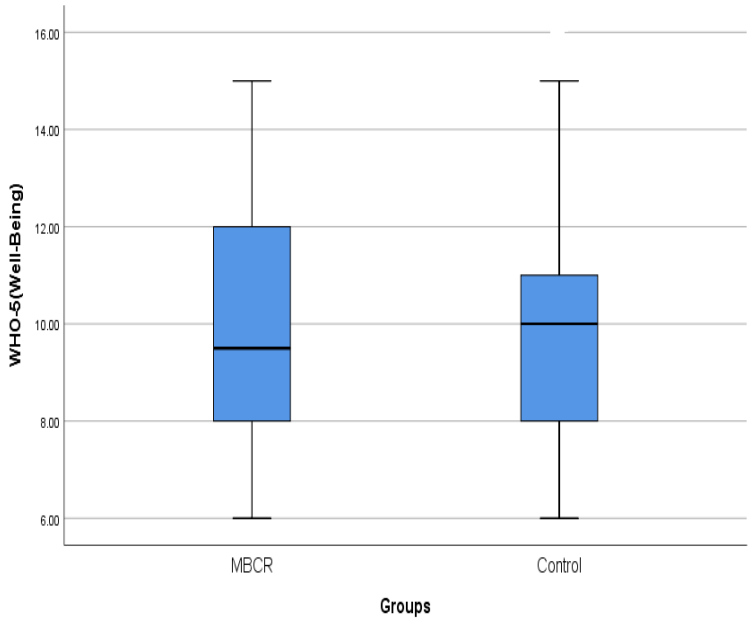

Figure 2 Box plot of normal distribution of WHO-5 scores

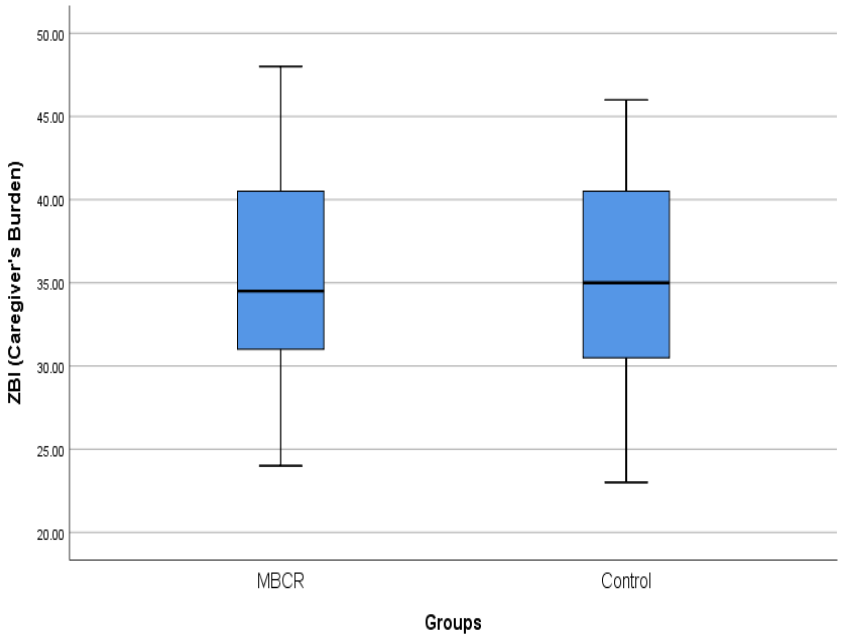

Figure 3 Box plot of normal distribution of ZBI scores

As can be discerned in Table 4, this issue that the scores of CDRS, WHO-5, and ZBI are statistically significant is suggestive of the change of dependent variables over time in three phases of the study. Paying attention to the between-subjects effects, the results show that the calculated F of all dependent variables (resiliency, PSW, CB) is significant. Moreover, looking in detail the findings reveal that the total scores of CDRS, WHO-5, and ZBI are different between the control group and the E-MBCR group. This means that the E-MBCR program was effective on the scores of all measurements among caregivers and improvement is gained. Furthermore the CDRS, WHO-5, and ZBI s' mean scores in the pre-test, posttest, and follow-up assessments in time * group interaction were significantly different between E-MBCR and the control group. This implies that resilience, PSW, and CB are influenced by time and group, in other words, the research treatment yielded different results in two groups. Figure 4-6 Depict linear trend analyses of the scores of the scales for both groups in three stages of the study (pretest, post-test, and follow-up).

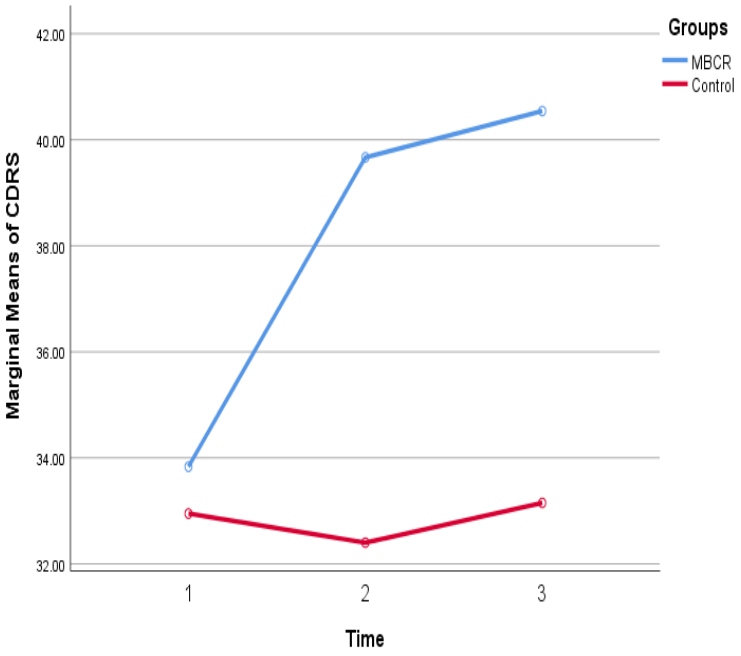

Figure 4 Changes of CDRS scores in three phases of treatment between two groups

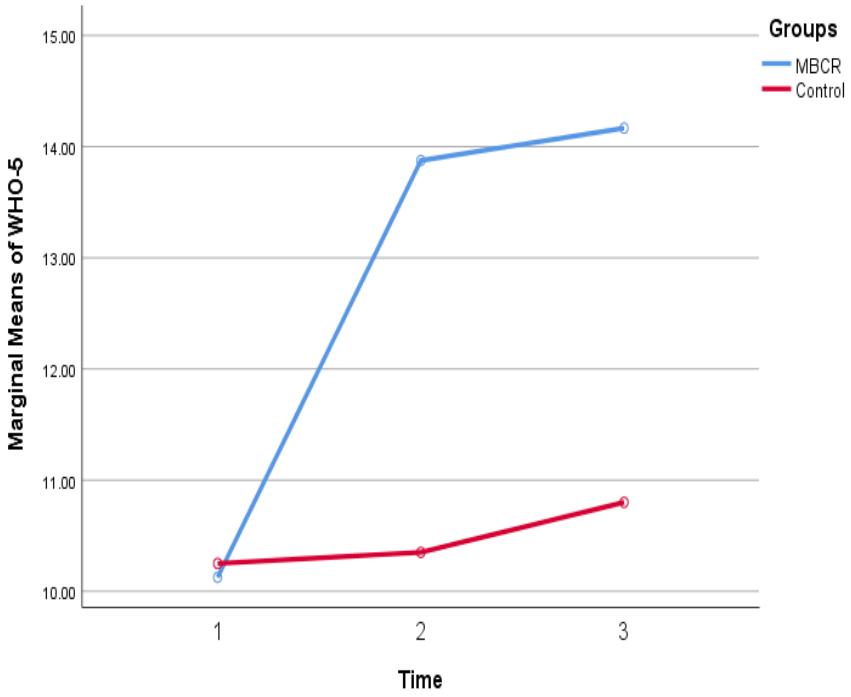

Figure 4 Changes of WHO-5 scores in three phases of treatment between two groups

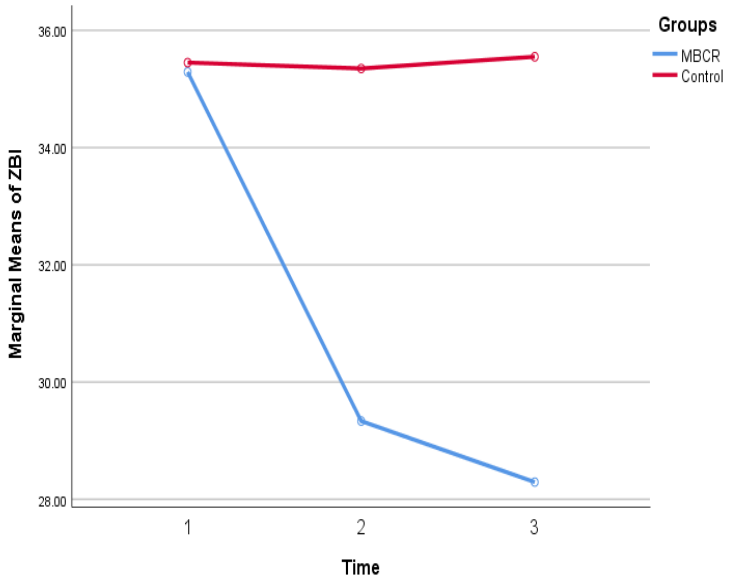

Figure 5 Changes of ZBI scores in three phases of treatment between two groups

In order to have a two-by-two comparison, Bonferroni post-hoc test was adopted. Table 5 shows the difference between the significant mean levels. Regarding CDRS, there is a significant variance between the pre-test with post-test and follow up scores, however, between post-test and follow up, the difference was not significant. Group comparisons showed that the adjusted mean was on an ascending trend that is, the mean was lower in the pre-test (M =33.83) in comparison with post-test (M =39.66) and follow-up (M = 40.54).

Table 5 Pairwise Comparison

variable		Mean difference	S.E	P
CDRC	Pretest-posttest	-5.83	0.83	0.000
	Pretest-follow up	-6.71	1.08	0.000
	Posttest-follow up	-0.87	0.99	1
WHO-5	Pretest-posttest	-3.75	0.39	0.000
	Pretest-follow up	-4.04	0.42	0.000
	Posttest-follow up	-0.29	0.22	0.600
ZBI	Pretest-posttest	5.95	0.71	0.000
	Pretest-follow up	7	0.61	0.000
	Posttest-follow up	1.04	0.33	0.014

E-MBCR: Internet- based Mindfulness-Based Cancer Recovery
CDRS: Connor and Davidson resilience scales
WHO-5: 5-item World Health Organization Well-Being Index
ZBI: Zarit Burden Interview
Note: (P<0.05)

Regarding WHO-5, between the scores of the pre-test with post-test and pre-test with follow-up there exist a significant difference, while this difference was not significant when looking at post-test and follow-up. Comparison of the groups showed that the adjusted mean was on an ascending trend that is the mean was lower in the pre-test (M =10.12) in comparison with post-test (M =13.87) and follow-up (M = 14.16). Regarding ZBI, a significant difference was remarkable between the scores of the pre-test with post-test and pre-test with follow-up, this difference was also significant when looking at post-test and follow-up. Comparison of the groups showed that the adjusted mean was on a descending trend that is the mean was higher in the pre-test (M =35.29) in comparison with post-test (M =29.33) and follow-up (M = 28.29).

4. DISCUSSION

The current study examined the effectiveness of E-MBCR on cancer patients' caregivers' PSW, CB, and resiliency. Virtually, this study is one of the pioneering one aiming at investigating the effectiveness of the E-MBCR program on cancer caregivers' psychological states. The study also has another fruitful benefit as it is the first to be done in a web-based format for cancer caregivers specifically, in Iran in the Covid-19 era during which caregivers are under twofold tensions and pressure. Collectively, the finding of this study illustrates the effectiveness of E-MBCR among caregivers. It seems that a 9-week intervention promoted both PSW and resiliency among caregivers both in post-test and follow-up. This is consistent with findings revealing the positive association between mindfulness and well-being (Pagnini et al., 2016), and the importance of mindfulness intervention in decreasing negative emotions and promoting positive feelings (Geng et al., 2019).

Several hypotheses provide plausible explanations for how mindfulness affects PSW and resiliency. Through mindfulness practices, people are encouraged to observe their negative inner feelings which they have had previously averted, therefore mindfulness stance may have increased their ability to tolerate these negative experiences and be more resilient. Many studies have pointed out the influential impact of mindfulness practices on psychological resilience (Cerezo et al., 2014; Aikens et al., 2014; Sood et al., 2011).

Furthermore, disregarding judgmental viewpoints and integrating an accepting attitude in lifestyle may have enabled the caregivers to accept their conditions, their roles, their responsibilities and learn to even get along with the human inability to change or control everything. Mindfulness-based treatments direct individuals to accept their thoughts, sensations, feelings without any effort to abstain from changing, or judging or elaborating mentally on their internal world, thus leading to reduction of ruminations, staying in here and now, tolerating psychological distress, and calmness of anxieties. Therefore, the individual gradually reaches this point to cope with distressing and overwhelming circumstances more resiliently and adapt more constructively while confronting challenging situations. This finding is not surprising as previous studies have duly pointed to a positive linkage between PSW and resilience (Sagone & De Caroli, 2014).

In addition, participating in modules revolving around life narratives and focusing on the meaning of life may have helped the caregivers to have mastery on their life viewpoint and cope with stress more effectively, through creating satisfying personal narratives and finding a meaning in this suffering situation. These experiences probably increased caregivers' ability to challenge their conditions. Adding to the abovementioned findings, a declining trend of CB was discerned after the intervention among participants in the E-MBCR group and this trend is continuing even after three months. This finding is in line with the finding of studies showing mindfulness as a positive intervention for caregivers (Sood et al., 2011). This could be the result of the learned content in the program.

During E-MBCR course practices, individuals learn to modulate their attitudes, promote cognitive flexibility by considering the differing point of view, for instance, a caregiver would be encouraged to search, find or create positive meaning in caregiving by reappraising the situation and creating more positive attitudes through different interpretations, therefore, become more capable in adjusting her/his feelings. This is in keeping with studies showing that after mindfulness caregivers are more able to adopt a more positive role in the caring process by putting away traditional ideas and fostering positive thinking with the aid of mindfulness techniques (Spitzer et al., 2003). In general, our findings lend support for the E-MBCR effectiveness on psychological components of cancer patients' caregivers.

Some limitations should be acknowledged. *First*, because of lack of long-term follow-up tracking, the maintenance of the effects of the treatment was not clear beyond three months. Future studies could extend the tracking time and investigate the maintenance of the results during longer duration. *Second*, though the recurrent reassurances were given to the participants regarding their confidentiality, desirability bias may have impacted the responses as the scales were self-reported. This could be a key component in future studies to overcome this issue. *Third*, generalizability of the findings is not ensured, because we applied technology as the main mean of gathering and delivering intervention, thus, comparison of groups with and without access to technology would be future research opportunities. Future studies could also include both caregivers and patients simultaneously to investigate whether the effects are bolstered or not.

5. CONCLUSION

Despite the limitations, encouraging findings have been yielded from this study. Our study showed that the E-MBCR approach can play an effective role in dealing with the psychological turmoil and emotional difficulties of cancer patients' caregivers. The findings of this study first highlight the essentiality of attending to burnout and mental fatigue in caregivers, whose distresses are endangering their mental health, and reducing their ability to support their patients. Governments and medical institutions could

establish campaigns with particular attention given to empowering caregivers and hire psychologists in oncology settings to reduce the imposed burden pressure both on caregivers and even health care teams to provide a secure atmosphere. Second, the web-based format intervention remarks the feasibility of applying the online interventions for those who are relatively remote from receiving psychological interventions due to their limitations such as the mass of responsibilities or mobility restrictions and limited access to face-to-face interventions. In this sense, regardless of Covid-19 social distancing, caregivers particularly in remote distances could also get the privilege of receiving psychological treatments at flexible times, even in occupational settings.

Authors' contribution

Conceptualization, Ahmad, Yousefi; Methodology and Formal analysis, Ahmad, Yousefi Investigation, Resources, Ahmad, Yousefi, Parastoo Naeimijoo; Data collection, Mojtaba Ghadiany, Ahmad Yousefi; Writing and original draft preparation, Ahmad Yousefi; Parastoo Naeimijoo; review and editing, Ahmad Yousefi, Parastoo Naeimijoo; Supervision, Maryam Bakhtiari; Maryam Aslzaker; Project administration, Abbas Masjedi Arani. All authors have read and agreed to the published version of the manuscript.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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