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Effects of a online brief modified mindfulness-based stress reduction therapy for anxiety among Chinese adults: A randomized clinical trial

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ABSTRACT

The COVID-19 pandemic has exacerbated anxiety and related symptoms among the general population. In order to cope with the mental health burden, we developed an online brief modified mindfulness-based stress reduction (mMBSR) therapy. We performed a parallel-group randomized controlled trial to evaluate the efficacy of the mMBSR for adult anxiety with cognitive-behavioral therapy (CBT) as an active control. Participants were randomized to mMBSR, CBT or waitlist group. Those in the intervention arms performed each therapy for 6 sections in 3 weeks. Measurements were conducted at baseline, post-treatment and 6 months post-treatment by Generalized Anxiety Disorder-7, Patient Health Questionnaire-9, Patient Health Questionnaire-15, reverse scored Cohen Perceived Stress scale, Insomnia Severity Index, and Snaith-Hamilton Pleasure Scale. 150 participants with anxiety symptoms were randomized to mMBSR, CBT or waitlist group. Post intervention assessments showed that mMBSR improved the scores of all the six mental problem dimensions (anxiety, depression, somatization, stress, insomnia, and the experience of pleasure) significantly compared to the waitlist group. During 6-month post treatment assessment, the scores of all six mental problem dimensions in the mMBSR group still showed improvement compared to baseline and showed no significant difference with the CBT group. Our results provide positive evidence for the efficacy and feasibility of an online brief modified MBSR program to alleviate anxiety and related symptoms of individuals from the general population, and the therapeutic benefits of mMBSR persisted for up to six months. This low resource-consuming intervention could facilitate the challenges of supplying psychological health therapy to large scale of population.

1. Introduction

Anxiety disorders are one of the most common type of mental illness, WHO ranks anxiety disorders as the ninth most health-related cause of disability due to its high prevalence, chronicity, and comorbidity(Disease et al., 2017). Anxiety disorders were reported to account for 3.3% of the global burden of disease(Gustavsson et al., 2011). Interventions for anxiety symptoms may reduce its chronicity and progression to mood disorders, but the proportion of people with anxiety and related mental health symptoms receiving treatment is low, especially in low- and middle-income countries(Cenat et al., 2021). The coronavirus disease 2019 (COVID-19) pandemic increased the incidence of anxiety and depression(Shi et al., 2020) (Huang et al., 2021), however, most countries have not been prepared to address the resultant mental health

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burden due to insufficient medical resources and lack of experienced psychiatrists(Belkin et al., 2021) (Chevance et al., 2020).

Mindfulness-based stress reduction (MBSR) is an intervention whereby individuals are taught to attend to the present moment in a non-judgmental and accepting manner(Chiesa and Serretti, 2009). As a non-drug strategy, MBSRs are preferable to conventional approaches in contexts such as health education, relaxation training, and supportive psychotherapy(Schmidt et al., 2011). Its clinical potential for preventing or alleviating anxiety and depressive episodes has been widely noted over the years(Hoge et al., 2023). A meta-analysis which included 47 randomized studies indicates that both in clinical and non-clinical populations, MBSR can improve mental health and reduce symptoms of stress, anxiety and depression(Goyal et al., 2014). MBSR has rarely been studied in Chinese population, as emotion regulation strategies differ culturally(Proulx et al., 2018), clinical research with east Asian populations may help to further explore how this intervention may facilitate emotion regulation in a healthy and adaptive way congruent with people's cultural values. The original version of MBSR has received broad support from empirical literature (Hofmann and Gomez, 2017), but there have been concerns about its high intensity and long duration (Nieuwsma et al., 2012) (Cuijpers et al., 2009) (Shapiro et al., 1994). Decreasing the intensity and length of the original MBSR may increase its practicality for a broader range of the general population. Many people with psychological disorders remain unable to access therapy programs because of practical barriers such as geographical distance, limited mobility, lack of well trained therapists and high costs(Creswell et al., 2017). Online interventions offer a feasible solution for these people. Online therapies frequently report efficacy rivaling those of the original interventions(Spijkerman et al., 2016) (Segal et al., 2020), and also showed advantages including low threshold accessibility, flexible use, independence of time and place, a high level of autonomy and privacy, and lower costs over in-person therapy.

Here, we performed a parallel-group randomized controlled trial (RCT) to evaluate the efficacy and feasibility of a six-session brief modified online mindfulness intervention in reducing anxiety symptoms and related mental health complaints among adults recruited from the general population. We used cognitive-behavioral therapy (CBT) as an active control, given its known effectiveness for adult anxiety(Kaczkurkin and Foa, 2015) and depression(Cuijpers et al., 2013). We hypothesized that our online brief modified MBSR (mMBSR) would significantly improve anxiety and related mental health symptoms in Chinese population. We tested its long-term benefits using up to six-month follow-up compared with individuals in the CBT active control group.

2. Materials & methods

2.1. Participants

Participants recruited between February 26 and March 15, 2020. After excluding those who didn't complete the questionnaire, 3071 participants who responded and completed the questionnaire delivered through a smartphone were invited to join this study. The questionnaire contained 79 questions, incorporating 66 multiple choice questions on depression and anxiety, somatic symptoms, insomnia, and anhedonia. The questionnaire data was compiled on a commercial website (wax.cn). Enrollment criteria including: (1) scores of Generalized Anxiety Disorder-7 (GAD-7) scale $\geq$5; (2) internet access via smartphone or computer; (3) Have enough visual and acoustic ability to complete the inspection required by this study; (4)Participate in this study on a voluntary basis. The exclusion criteria including: (1) severe or life-threatening suicidal ideation; (2) severe or unstable physical disorder; (3) a history of substance or alcohol abuse within six months before screening; (4) cognitive impairment or medical illness that could interfere with treatment; (5) previous experience of daily meditation practice and cognitive behavioral therapy; (6) history of antipsychotic medication in the previous two weeks, and long-acting injection of antipsychotic drugs; (7) evidence of current or previous head injury, CNS disease, or other ICD-10 disorders; (8) participation in other psychological interventions at the same time. One hundred and fifty individuals aged 18–55 years willing to participate were recruited. All the participants provided written and informed consent. Tongji Medical College of Huazhong University of Science& Technology approved the study protocol and informed consent procedures (TJ-IRB20200327). Trial Registration: Chinese Clinical Trial Registry (ChiCTR2000030832) (https://www.chictr.org.cn/com/25/index.aspx).

2.2. Study design

This study is a parallel-group RCT designed to examine the efficacy of a novel brief modified MBSR delivered by smartphone over six sessions by a certified MBSR trainer for anxiety and related psychological symptoms in the Chinese population. A waitlist group served as negative control group and an online administered CBT group which consisted of 6 sessions and delivered by certified CBT therapist served as active control. Participants were assigned to one of the three treatment groups by computer-generated random numbers in equal proportions. The trial design of this online study is summarized in Fig. 1.

Participants completed self-report assessments online; the dataset was blinded, hence, the research team was blind to outcomes during the trial. Participants were informed of their randomization outcome by a WeChat message, such that they were not blind to their treatment allocation. The research team had limited contact with research participants (occasional WeChat message to remind to participate in therapy etc.), and therefore could not bias the group allocation or influence the assessments. If participants did choose to contact the team and reveal their allocation, the assessments remained blind. Statistical analyses conducted by an independent researcher who had unblinded access to all data.

2.3. Interventions

Intervention delivery was structured into six sessions, administered twice a week for three weeks with a daily homework. The interventions were conducted in an group-based live video-conference led by a trainer (with degree as clinical psychologist and with certification of psychotherapy) for approximately 60 min each session. Group members could see each other on their computer or smart phone screen and were allowed to ask questions. Their privacy was protected by participating anonymously and less sharing of personal experiences. The mMBSR was a condensed and refined version, it consisted of education about mindfulness principles, informal mindfulness exercises, compassion practice and meditations. The online CBT intervention consisted of education about depression and anxiety, the CBT cycle, as well as core CBT skills. More details are displayed in the supplementary material. Participants in the waitlist group received no professional psychotherapy for the duration of the intervention, they were informed to wait for 3 weeks. During the 3-week period, if there was an emergency for psychiatric support, they could contact the research team for crisis intervention and/or obtain resources for mental health services. After the wait period, the participants in the waitlist group were free to choose CBT or mMBSR treatment. A psychotherapy assistant for each group monitored each participant's progress throughout the trial. The clinician provided post-session feedback lasting 10–15 min per participant per session over the three-week intervention period to collect questions from participants and problems encountered during practice, so as to answer questions of common concern in the next section.

2.4. Outcome measures

Primary outcomes were improvement in anxiety, somatization, the experience of pleasure, depression, stress, and insomnia compared to the

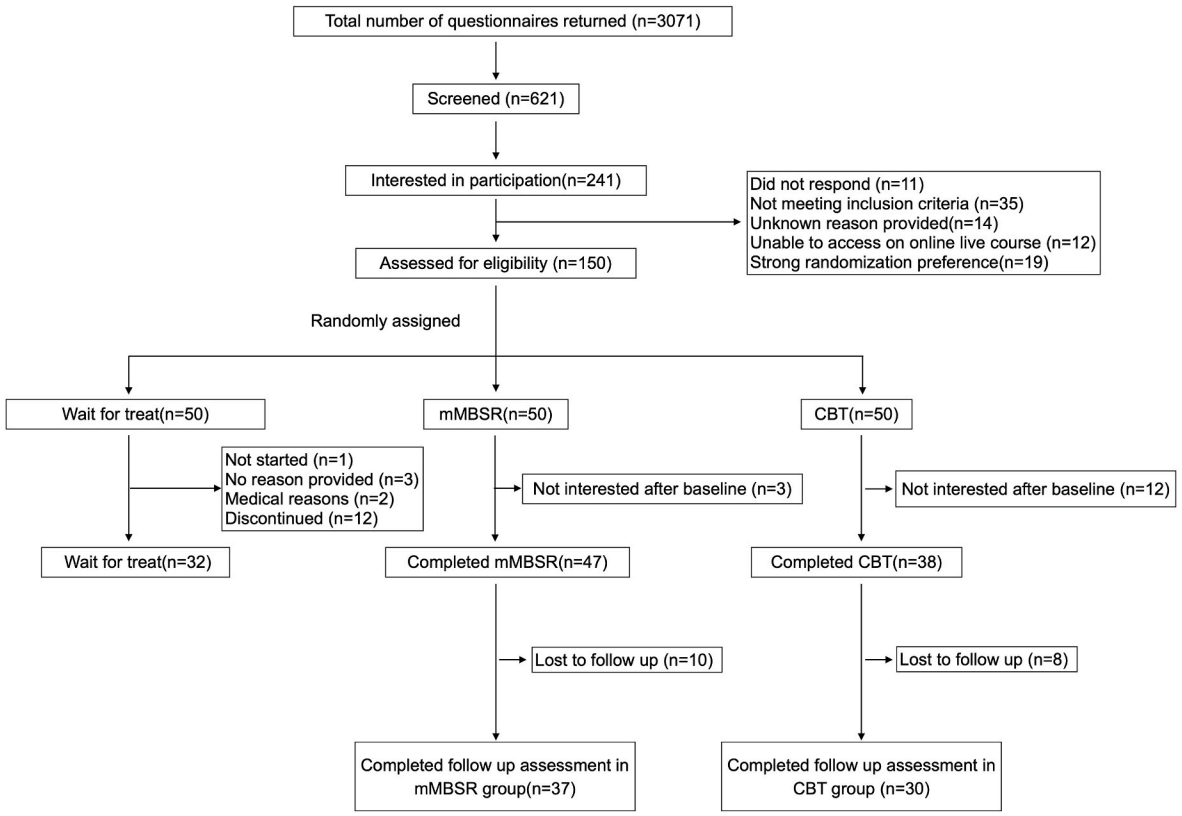

Fig. 1. The CONSORT diagram.
Abbreviation: mMBSR, modified Mindfulness-based stress reduction; CBT, cognitive-behavioral therapy.

waitlist group at week 3 (post-treatment). Secondary outcomes were improvement in anxiety, depression, somatization, stress, insomnia and the experience of pleasure compared to the CBT group at month 6 (follow-up). Patient Health Questionnaire-9 (PHQ-9) (Wang et al., 2014) and Generalized Anxiety Disorder-7 (GAD-7) (Lowe et al., 2008) were used to assess the severity of depression and anxiety symptoms, respectively. The perception of stress and pleasure were evaluated by Snaith-Hamilton Pleasure Scale (SHAPS) (Snaith et al., 1995) and reverse scored Cohen Perceived Stress scale (PSS-14) (Cohen et al., 1983) respectively. Somatic symptoms were measured by Patient Health Questionnaire-15 (PHQ-15) (Tong et al., 2016); and the presence and severity of insomnia was measured by Insomnia Severity Index (ISI) (Bastien et al., 2001).

2.5. Sample size and statistical analysis

The sample size estimation was conducted using G*Power (version 3.1, Universitat Kiel, Kiel, Germany). We based ɑ level of 0.05, power (1-β) of 90%, and effect size of 0.35, giving a total of 107 individuals required. Considering a drop-out of ~30%, we recruited 150 individuals.

Two researchers entered data into the database using Epidata.3.0 in a blind manner to guarantee accuracy. Continuous variables were described as mean (SD) if they were normally distributed or as medians (IQR) if not normally distributed, and were then compared using the Mann-Whitney *U* test. Categorical variables were delineated as n (%) and compared by the $\chi 2$ and Fisher's exact tests. The curative effect comparison of each dimension score among different intervention groups entailed an analysis of covariance (ANCOVA), in which the pretest score of each dimension scale served as the covariate, and the post-test score was the dependent variable. The long-term effects of different treatment groups were compared using repeated-measures analysis of variance. Post hoc analyses were corrected for multiple testing by Bonferroni's correction. All statistical analyses were performed using SPSS19.0, with $\alpha = 0.05$ as the inspection level.

3. Results

3071 individuals started the online screening process, of whom 671 (22%) reported psychological symptoms and an expressed need for psychotherapy. Two hundred forty-one individuals agreed to participate in this online treatment, finally, 150 individuals met all eligibility criteria were recruited in our study. Therefore, 50 participants each were assigned to the waitlist, CBT, and mMBSR group randomly. The baseline information including sex, age, marital status, education status and dwelling state of the participants in the three groups had no statistical differences. As well, we collected self and family infection status of COVID-19 of the individuals, since this study was conducted during the COVID-19 pandemic. The majority of participants were female (83.33%), married (73.33) and educated to university level (86.00%). Before interventions began, we conducted the first psychological assessment of the participants by online scales. No statistical difference was found in the scores of GAD-7, PHQ-9, PHQ-15, PSS-14, SHAPS, and ISI (Supplementary Table 1).

Eighteen participants (36.00%) in the waitlist group withdrew or were lost to follow-up at the end of 3-week intervention, versus three (6.00%) in the mMBSR group and twelve (24.00%) in the CBT group. Thus, 32 participants in the control waitlist group, 47 in the mMBSR group and 38 in CBT group were included in our final analysis. Table 1 provided the essential demographic information including sex, age, marital status, education status, dwelling state, and status of COVID-19 infection for the three groups. Chi-squared testing did not indicate any group difference in these demographics ($P > 0.05$), this indicated that attrition did not cause bias. After 3-week intervention, anxiety assessed by GAD-7 remitted in 26% of participants in the waitlist group, 80% in the MBSR group, and 56% in the CBT group respectively. We used the

Table 1
Baseline information of the participants.

Characteristic		Waitlist	mMBSR	CBT	P
Gender	Males	6	6	4	0.591
	Females	26	41	34	
Age groups	≤35	12	19	19	0.81
	36–45	10	14	11	
	≥45	10	14	8	
Education level (Years)	≤12	5	5	6	0.736
	>12	27	42	32	
Marital status	Unmarried	7	8	13	0.268
	Married	25	35	24	
	Divorced	0	2	1	
	Widowed	0	2	0	
Dwelling state	Living alone	3	9	8	0.386
	Living together	29	38	30	
Infection status of COVID-19	Self	0	3	1	0.495
	Family members	4	4	6	
	Not infected	28	40	31	

covariances of the examination scores to explain the therapeutic effect of interventions from baseline to three weeks in each group. As demographic factors including gender, age, education level marital status, dwelling state and infection status of COVID-19 may impact the outcome of anxiety and related mental health, ANCOVA was used to explore the influence of these covariance. It indicated that there were only significant group differences in the six mental problem dimensions ($P < 0.001$ for GAD-7, PHQ-9, PHQ-15, PSS-14, SHAPS, and $P = 0.001$ for ISI) (Table 2). Post hoc test following an intention-to-treat approach showed that the scores of GAD-7 (11.26 ± 0.79 vs 4.90 ± 0.63, $p < 0.001$), PHQ-9 (12.74 ± 0.85 vs 6.16 ± 0.57, $p < 0.001$), PHQ-15 (10.68 ± 0.77 vs 7.00 ± 0.63, $p < 0.001$), and ISI (11.48 ± 1.07 vs 7.10 ± 0.80, $p < 0.001$) in the mMBSR treatment group were significantly lower than those in the waitlist group, and the score of PSS-14 (24.42 ± 1.12 vs 32.12 ± 1.09, $p < 0.001$) and SHAPS (27.50 ± 1.03 vs 31.96 ± 0.79, $p < 0.001$) were significantly higher, meaning that mMBSR therapies improved the performance in all the six dimensions. Similar result was achieved when following a per-protocal approach (Supplementary Fig. 1). The scores of GAD-7, PHQ-9, PHQ-15, PSS-14, SHAPS and ISI in the CBT group were similar to those in the mMBSR group ($p > 0.05$) (Fig. 2).

A third examination was given to the individuals in the mMBSR ($n = 37$, attrition rate = 26.00%) and the CBT ($n = 30$, attrition rate = 40.00%) groups at six months after intervention. Anxiety assessed by GAD-7 remained remitted in 62% participants in the MBSR group and 44% in the CBT group respectively. Data was analyze following an intention-to-treat approach. In all the six mental problem dimensions, the two group's scores were not significantly different ($P_{group} > 0.05$), which indicated the mMBSR treatments were comparable in efficacy to CBT. The ANOVA of scores as a function of time showed significant differences in all six psychological problem dimensions ($P_{time} < 0.001$). Fig. 3 showed further pairwise comparisons of different time points. In the mMBSR group after three-week intervention, there were lower scores of GAD-7 (8.87 ± 0.74 vs 4.64 ± 0.62, $P < 0.001$), PHQ-9 (10.24 ± 0.61 vs 6.0 ± 0.64, $P < 0.001$), PHQ-15 (10.95 ± 0.75 vs 7.08 ± 0.71, $P < 0.001$), ISI (10.81 ± 1.13 vs 6.67 ± 0.71, $P < 0.001$), and higher

Table 2
Factors associated with the covariance of psychological problems' scores.

Characteristic		GAD-7		PHQ-9		PHQ-15		PSS-14		ISI		SHAPS	
		X±SE	P	X±SE	P	X±SE	P	X±SE	P	X±SE	P	X±SE	P
Groups	Waitlist	9.74 ± 0.65	<0.001	11.70 ± 0.82	<0.001	10.62 ± 0.70	<0.001	26.56 ± 1.08	<0.001	9.90 ± 0.74	0.001	27.45 ± 0.92	<0.001
	mMBSR	4.37 ± 0.54		6.08 ± 0.68		6.22 ± 0.59		33.00 ± 0.89		6.24 ± 0.61		32.12 ± 0.76	
	CBT	5.14 ± 0.60		6.50 ± 0.76		7.05 ± 0.65		31.24 ± 0.99		7.71 ± 0.68		32.13 ± 0.85	
Gerder	Males	6.91 ± 1.07	0.414	9.34 ± 1.30	0.192	7.74 ± 1.09	0.966	29.34 ± 1.65	0.387	6.23 ± 1.09	0.145	29.57 ± 1.42	0.333
	Females	6.00 ± 0.43		7.50 ± 0.52		7.69 ± 0.43		30.88 ± 0.66		7.95 ± 0.43		31.05 ± 0.55	
Age groups	≤35	6.80 ± 0.60	0.199	8.50 ± 0.74	0.368	8.20 ± 0.62	0.559	29.79 ± 0.94	0.403	8.28 ± 0.62	0.269	30.08 ± 0.78	0.262
	36–45	6.01 ± 0.72		7.47 ± 0.88		7.34 ± 0.74		30.85 ± 1.12		6.73 ± 0.74		30.76 ± 0.94	
	≥45	5.05 ± 0.76		6.89 ± 0.92		7.29 ± 0.78		31.83 ± 1.18		7.93 ± 0.78		32.14 ± 0.98	
Education level (Years)	≤12	6.95 ± 1.08	0.39	7.88 ± 1.32	0.917	8.05 ± 1.09	0.728	30.51 ± 1.66	0.917	7.82 ± 1.10	0.919	31.08 ± 1.40	0.857
	>12	5.95 ± 0.43		7.73 ± 0.52		7.64 ± 0.43		30.69 ± 0.66		7.70 ± 0.44		30.81 ± 0.56	
Marital status	Unmarried	7.15 ± 0.81	0.246	8.74 ± 0.98	0.332	8.41 ± 0.83	0.144	28.78 ± 1.24	0.243	8.59 ± 0.85	0.092	30.58 ± 1.04	0.207
	Married	5.81 ± 0.47		7.55 ± 0.57		7.64 ± 0.43		31.14 ± 0.72		7.61 ± 0.48		30.85 ± 0.60	
	Divorced	6.85 ± 2.48		7.85 ± 3.00		7.06 ± 2.48		31.34 ± 3.81		7.62 ± 2.49		28.11 ± 3.19	
	Widowed	1.77 ± 3.03		2.14 ± 3.69		1.01 ± 3.05		36.38 ± 4.64		0.36 ± 3.08		38.48 ± 3.91	
Dwelling state	Living alone	5.20 ± 0.97	0.317	7.75 ± 1.21	0.997	6.21 ± 0.98	0.099	30.94 ± 1.48	0.838	7.37 ± 1.00	0.706	31.98 ± 1.25	0.319
	Living together	6.27 ± 0.44		7.75 ± 0.54		8.00 ± 0.44		30.61 ± 0.67		7.79 ± 0.45		30.61 ± 0.56	
Infection status of COVID-19	Self	5.05 ± 2.17	0.876	4.82 ± 2.63	0.528	5.40 ± 2.18	0.554	30.19 ± 3.34	0.99	2.06 ± 2.14	0.01	31.37 ± 2.78	0.405
	Family members	6.31 ± 1.16		7.88 ± 1.40		7.99 ± 1.17		30.70 ± 1.78		9.60 ± 1.14		28.96 ± 1.49	
	Not infected	6.10 ± 0.44		7.85 ± 0.53		7.74 ± 0.44		30.68 ± 0.67		7.68 ± 0.43		31.09 ± 0.56	

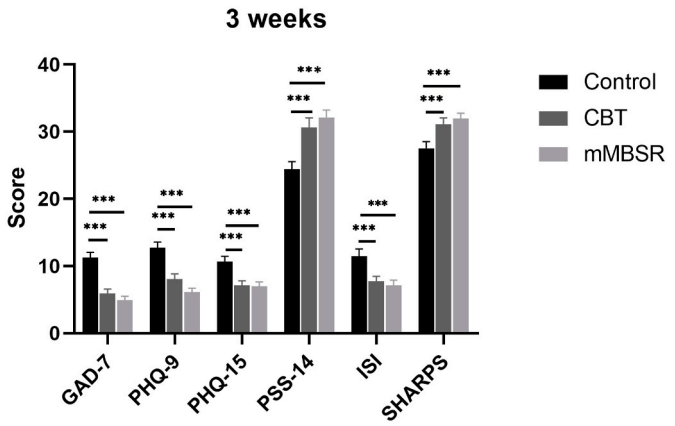

Fig. 2. Differences between scores of mMBSR, CBT and waitlist groups at the end of 3-week treatment.
Abbreviation: PHQ-9, Patient Health Questionnaire-9; GAD-7, Generalized Anxiety Disorder-7; SHAPS, Snaith-Hamilton Pleasure Scale; PSS-14, Cohen Perceived Stress scale; PHQ-15, Patient Health Questionnaire-15; ISI, Insomnia Severity Index. ***, $P < 0.001$; **, $P < 0.01$; *, $P < 0.05$.

scores of PSS-14 (24.70 ± 1.48 vs 31.32 ± 1.55, $P < 0.001$) and SHAPS (27.87 ± 0.89 vs 32.52 ± 1.01, $P < 0.001$) compared to the baseline. Moreover, at six months, scores of all the six psychological problem dimensions still showed significant difference compared to baseline ($P < 0.001$), and did not differ significantly compared to the scores at three weeks ($P > 0.05$). Corresponding results were similar in the CBT group, but showed lower score in ISI and higher score in SHARPS without statistic difference compared to the baseline. No significant difference was found between mMBSR and CBT group at six-month follow up in the scores of all the six psychological problem dimensions ($p > 0.05$). Similar result was achieved when following a per-protocal approach (Supplementary Fig. 2).

4. Discussion

The prevalence of mental health problems is high all over the world, however, most nations are not well prepared for the increasing need of mental health care, especially those developing countries with relatively less capacity of mental health services(Penninx et al., 2021). The increasing mental health issues caused by the COVID-19 pandemic, which include fear of infection, potential negative socio-economic impacts such as unemployment and economic downturn, and worries about access to necessities, have further emphasized the need for mental health therapy(Holmes et al., 2020) (Pfefferbaum and North, 2020). Developing easy and effective methods to address psychological problems is emerging as a priority.

Our present results suggested that a brief online mMBSR can rapidly alleviate psychological problems including self-reported anxiety and depression, showing similar effects to conventional CBT. Moreover, the mMBSR and CBT interventions showed long-lasting effects for up to 6-month. To our knowledge, this is the first randomized clinical trial providing long-term evidence of an online brief mMBSR intervention to mitigate the psychological problems experienced by the general population during the COVID-19 pandemic.

There is considerable evidence to support the efficacy of mindfulness-based interventions on mental health outcomes in regular in-person formats(Zhang et al., 2021), but the standard curriculum for MBSR is delivered in a structured 8-week group format that involves weekly 2.5-h group sessions and a 6-h day-long retreat, resulting in a total of 26 contact hours(Carmody and Baer, 2009). Mindfulness therapy has not been widely implemented in low and middle income countries due to barriers and challenges related to its time-consuming characteristics. There is also a dearth of studies that focus on investigating its therapeutic effect as low-threshold interventions which are required especially during a health crisis such as the COVID-19 pandemic(Fiol--DeRoque et al., 2021). With the popularization of the internet and smartphones, online mindfulness intervention is emerging as a readily available, low-cost, and convenient way of psychotherapy(Spijkerman et al., 2016) (Reese et al., 2021). Preliminary studies have confirmed that online and traditional mindfulness therapy have comparable efficacy(Murray et al., 2015). In this study, we intended to test the effects of MBSR in an online video-conference format in China. This group-based therapy format not only has a better potential for widespread implementation, but also ensures privacy. In hope of further improving the utility among the general population, we chose a brief modified MBSR set-up, in which we condensed the curriculum of MBSR in to six sections. Such brief interventions, conducted purely online and costing only six contact hours, might be particularly effective in the current pandemic context and also in future large-scale mental health prevention programs.

CBT has been developed from psychological research to overcome difficulties in problem-solving when dealing with negative emotions (Wenzel, 2017). A large amount of research has accumulated showing the effectiveness of CBT for anxiety disorders(Kaczkurkin and Foa, 2015), and indeed, CBT is also the most intensely studied psychotherapy. A meta-analysis of 115 studies has confirmed that CBT is comparable to the efficacy of pharmacotherapy(Cuijpers et al., 2013). Both MBSR and CBT appear to have a positive effect on anxiety. However, implementing CBT requires highly trained therapists, patient access to CBT is limited, and CBT was suggested to be more effective when delivered individually rather than in a group setting(Moreno et al., 2013). In this specific context, patients are more willing to engage in mindfulness rather than CBT during the early phase of their treatment (Cherkin et al., 2016). Moreover, CBT has been reported to have a higher attrition rate than MBIs in Internet-based interventions(Kennett et al., 2021) (Mak et al., 2017) (Li et al., 2021), a similar phenomenon also appears in our study. Following intention-to-treat approach, the CBT group did not reach statistic difference for GAD-7, PSS-14 and ISI at six month comparing with the baseline maybe mainly because the higher attrition rate. Thus, MBSR which offers a low-cost treatment with better acceptability may be more appropriate for group-based online interventions.

In this study, we used CBT as active control to provide relative long-term efficacy information of this online mindfulness program, and we found that both interventions' therapeutic benefits persisted for up to six months. This suggests that mind-body treatments such as MBSR and CBT may provide patients with effective long lasting skills for psychological symptoms. However, further research is needed to evaluate the benefits beyond 1 year, to determine its cost effectiveness, and to determine the minimum number of sessions required.

Our study has several limitations. First, our sample size is small, the over representation of females and high educational level in our participant groups may indicate a selection bias that would limit the generalizability of our results. However, a higher prevalence of anxiety and depression is typically reported in women(Wang et al., 2020), and other studies of online therapy also showed that most of the subjects were female(Segal et al., 2020) (Breedvelt et al., 2021). That's probably because women have a higher incidence of psychological disorders and a higher desire to seek treatment. Second, the evaluation tools are all self-rating scales which are more subjective than a structured interview or bio-markers, so this study is limited to its brief and nondiagnostic nature. Future research should use more comprehensive mental health assessments, ideally including diagnostic assessment by a clinician. However, all variables were based on standardized questionnaires, and many of the targeted outcomes (e.g., pleasure and psychological distress) are by their very nature, subjective. Third, due to technical limitations, we could not accurately record the participants' course study duration and the amount of time participants spent doing homework, and thus we could not explore the relationship between duration

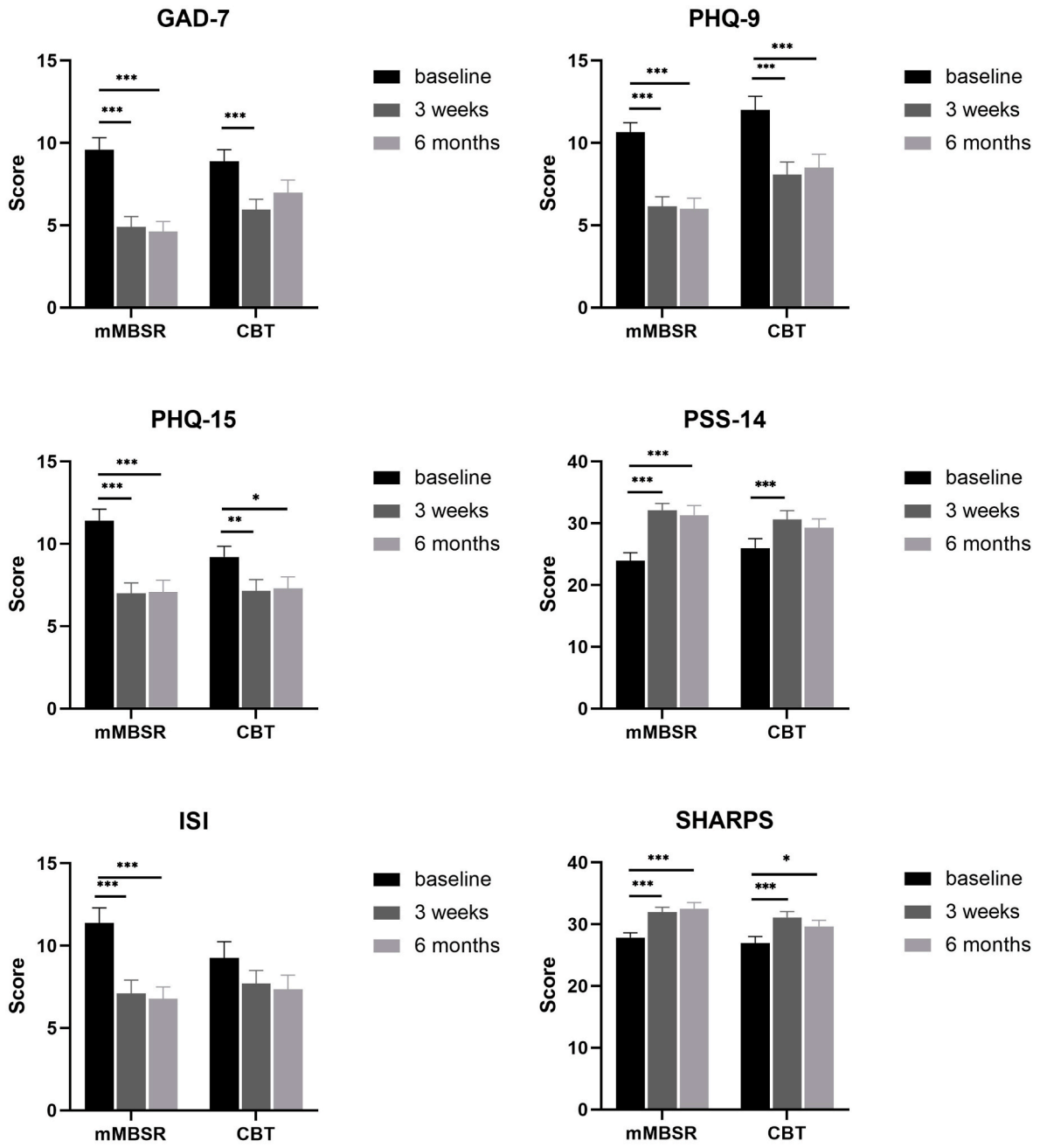

Fig. 3. Scores of mMBSR and CBT groups at baseline, 3 weeks of treatment and 6 months' follow-up.
Abbreviation: PHQ-9, Patient Health Questionnaire-9; GAD-7, Generalized Anxiety Disorder-7; SHAPS, Snaith-Hamilton Pleasure Scale; PSS-14, Cohen Perceived Stress scale; PHQ-15, Patient Health Questionnaire-15; ISI, Insomnia Severity Index; mMBSR, modified Mindfulness-based stress reduction; CBT, cognitive-behavioral therapy.***, $P < 0.001$; **, $P < 0.01$; *, $P < 0.05$.

of CBT or MBSR study with the magnitude of benefits from the online psychological interventions.

5. Conclusions

Our results provide positive evidence for the efficacy and feasibility of an online brief modified MBSR program in which we condensed the curriculum of MBSR in to six sections to alleviate anxiety and related symptom of individuals from the general population, and the intervention's therapeutic benefits persisted for up to six months. This low resource-consuming intervention may help address the challenges of supplying psychological therapy to a large scale population.

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Author statement

All authors critically edited the report, and all read and approved the final edition. We declare that the work described has not been published previously, and that it is not under consideration for publication elsewhere. Its publication is approved by all authors and explicitly by the responsible authorities where the work was carried out. If accepted, it

Declaration of Competing interest

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

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