

Effects Of Modified Mindfulness-Based Stress Reduction (MBSR) On The Psychological Health Of Adolescents With Subthreshold Depression: A Randomized Controlled Trial

This article was published in the following Dove Press journal:
Neuropsychiatric Disease and Treatment

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Background: Sub-threshold depression (SD) has been associated with impairments in adolescent health which increase the rate of major depression. Researchers have shown the effectiveness of mindfulness on mental health, however whether the traditional mindful skills were suitable for youngsters, it was not clear. This study investigated the effects of a tailed Mindfulness-based stress reduction (MBSR) on their psychological state.

Methods: A double-blind, randomized controlled trial was carried out. 56 participants who met the inclusion criteria agreed to be arranged randomly to either the MBSR group (n=28) or the control group (n=28). Participants in MBSR group received a tailored 8-week, one time per week, one hour each time group intervention. The effectiveness of intervention was measured using validated scales, which including BDI-II, MAAS, RRS at three times (T1-before intervention; T2-after intervention; T3-three months after intervention). A repeated-measures analysis of variance model was used to analyze the data.

Results: The results showed significant improvements in MBSR group comparing with control group that depression level decreased after the 8-week intervention and the follow up ($F=17.721, p < 0.00$). At the same time, RRS score was significantly decreased at T2 and T3 ($F=28.277, p < 0.00$). The results also showed that MBSR promoted the level of mindfulness and the effect persisted for three months after intervention ($F=13.489, p < 0.00$).

Conclusion: A tailored MBSR intervention has positive effects on psychology health among SD youngsters, including decrease depression and rumination level, cultivate mindfulness.

Keywords: mindfulness, adolescent, subthreshold depression

Introduction

Subthreshold depression (SD), also known as subsyndromal depression, subclinical depression, or mild depression, refers to a state or a subpopulation of individuals who have certain depressive symptoms but do not meet the diagnostic criteria for major depressive disorder.¹ A previous study found that the incidence of subthreshold depression was significantly higher than that of major depressive disorders, with an estimated prevalence rate of 25% worldwide, and it had a serious impact on individual life and social psychological function.² However, there is little agreement on how to address the diagnosis of subthreshold depression; modern classification systems such as the Diagnostic and Statistical Manual of Mental Disorders,

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Fourth Edition (DSM-IV) have established diagnostic categories for subsyndromal depressive symptoms, including “dysthymia,” “brief recurrent depression,” and “minor depressive disorder”.³ Subthreshold depression is considered to be the precursive stage of major depressive disorder and can predict the occurrence of major depressive disorder in individuals in the future. It should be made clear that it is increasingly recognized that individuals with subthreshold depression do not have a similar prognosis to those who are asymptomatic, and are in fact at elevated risks of later depression and suicidal behaviors.⁴ Individuals with subthreshold depression have an odds ratio of more than 5 for having a first lifetime episode of major depression disorder.⁵ Meanwhile, subthreshold depression has also increased the risk of adverse outcomes such as drug abuse and dependence. In recent years, the incidence of subthreshold depression in adolescents has grown rapidly and as high as 36.56%.² There are adolescents with subthreshold depression who have not yet met the diagnostic criteria for depression, but subthreshold depression has caused a decline in their social function and has placed them at a higher risk of experiencing depressive episodes, which should be highly concerning.⁶ However, there are limited studies focus on investigating an effective and feasible way to help adolescents with subthreshold depression improve their psychological health.

Mindfulness, derived from Buddhist meditation, is described as a state of being purposeful and giving non-judgemental attention to the present moment. Its core elements are “the ability to focus on the present” and “keep a curious, open and receptive attitude”.⁷ Mindfulness intervention is a psychological treatment, which refers to a series of psychological training methods based on “mindfulness,” that can help individuals cultivate and enhance mindfulness. In the late 1970s, American psychologist Kabat-Zinn introduced and developed mindfulness-based stress reduction (MBSR) psychotherapy, which was praised as “the third wave of behavioral and cognitive therapy”.⁸ MBSR is a systematic non-drug psychological therapy that includes four basic mindfulness skills. Through mindfulness meditations, body awareness and yoga, MBSR can awaken inner mindfulness and improve self-regulation to help people relieve stress. At present, MBSR has been widely used in medical treatment and has become an important part of the biopsychosocial approach medical system to promote psychology and physical health.⁹ Studies have shown that MBSR can alleviate

anxiety and depression among cancer patients.^{10,11} A recent meta-analysis showed that yoga-based interventions, including mindfulness practice, had significant beneficial effects for pregnant women with mild depressive symptoms.¹² However, due to differences in cultural and religious beliefs and economic levels, whether MBSR is suitable for the Chinese adolescent population needs further investigation.

Mindfulness therapy includes formal and informal techniques. The traditional form of mindfulness-based stress reduction therapy is group intervention. Each group is limited to approximately 30 people with 8 practice times of 2 to 2.5 hrs each.¹³ However, due to time constraints or hard-to-grasp core skills, many people suspend or quit psychological treatment. For adolescents, due to their immature psychological adjustment mechanism, it is difficult for them to grasp the core of mindfulness skills related to meditation in a short amount of time.¹⁴ The best way to perform psychological intervention is to allow adolescents to apply the techniques to their life and integrate them into their life over time, thus improving their psychological health. Fewer studies have focused on the longitudinal effects of mindfulness skills on adolescents in China.¹⁵ Therefore, a tailored MBSR programme for adolescents with rigorous and well-controlled randomized trials is needed to further test the long-term effects of modified MBSR on the psychological health of adolescents.

This study was designed to evaluate the effects of a tailored simplified MBSR on the psychological health of adolescents with subthreshold depression, including depression levels, rumination and mindfulness levels, in a randomized controlled trial. We hypothesized that modified MBSR training would provide evidence for improving psychological health, thus decreasing depression and rumination levels and increasing mindfulness in Chinese adolescents with subthreshold depression.

Methods

Study Design

This study was a randomized controlled design with double-blind subjects. All participants were divided equally into the MBSR training group and the control group using the random number table by staff members who were independent from the study. All participants received the anonymous letters and they were blinded to their random assignment until the end of the session. When the study was completed, the control group received the same

intervention according to their own wishes. The intervention was conducted at the psychological interview room carried out by a qualified psychologist. The anonymous data were collected and analyzed by an assistant who was blinded to the group assignment and all the trials. The design of the entire study is illustrated in a flow diagram in Figure 1.

Sample And Setting

The sample-size estimation in this study was calculated by using the G*POWER version 3.1 program with a power ($1-\beta$) of 0.80 in the paired-samples *t*-test and a significance level of 0.05. Based on the related data,¹⁶ we established an effect size (*d*) of 0.796; consequently, the total sample size was 52 participants. Allowing for a 5–10% dropout rate, we recruited 56 students in September 2017. Participants were enrolled by putting up a poster on campus. We used two steps to recruit the participants. First, all of the interested students completed questionnaires (Beck depression inventory, BDI and self-rating depression scale, SDS). Participants who had a BDI>14 and an SDS>53 were defined as the preliminary screening group. Second, the structured clinical interview for DSM (SCID) was conducted among the preliminary screening group by a

psychologist to perform the second screening. The exclusion criteria were as follows: i) had recently suffered from major stress events; and/or ii) had major depressive disorder, bipolar disorder or other types of mental illnesses. A total of 291 students agreed to participate in the study, and in the end, the study included 56 participants who met the following inclusion criteria: i) volunteered for this study and agreed to obey the rules during the intervention and ii) had subthreshold symptoms of depression (as defined by the questionnaires and structured interviews). Participants who had participated in or were participating in similar interventions (such as yoga or meditation) were also excluded. All participants provided their written consent. The study was approved by the institutional review board at Harbin Medical University (Daqing) and this trial was conducted in accordance with the Declaration of Helsinki.

Intervention

The MBSR Intervention Group

Participants allocated to the MBSR training groups received 8 weeks of modified MBSR training. Based on traditional MBSR theory, the intervention was tailored according to the characteristics of adolescents and emphasized teaching them to apply formal techniques such as body scanning, sitting meditation, and mindfulness yoga to

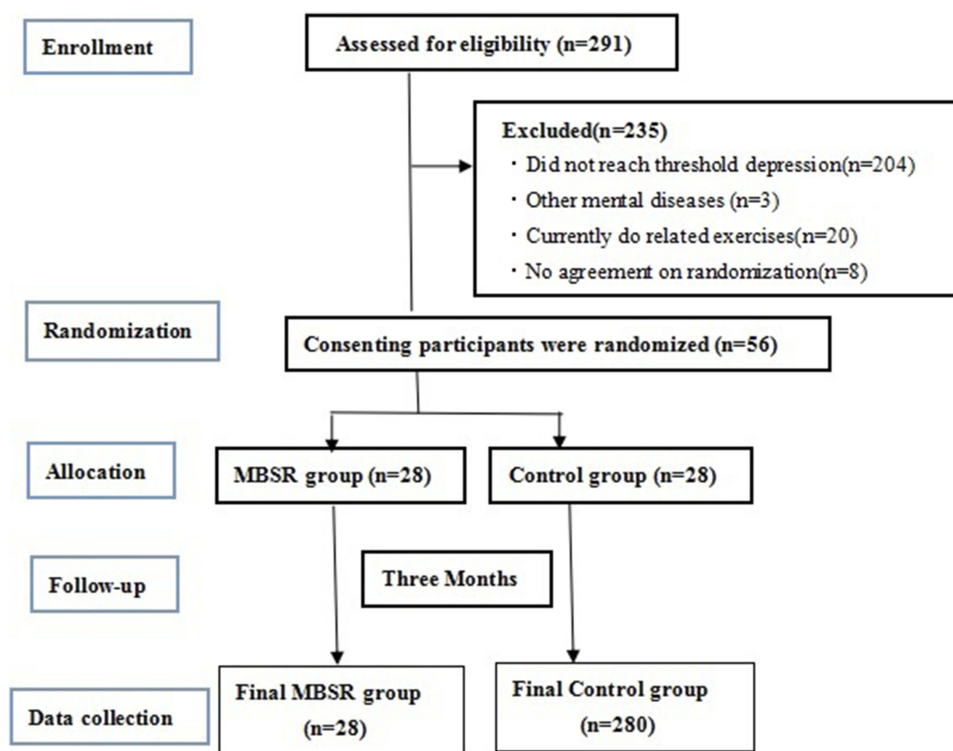


Figure 1 Study flow diagram: enrollment to analysis.

all aspects of the practitioner's life, including experiencing the pleasant/sad moments in life, walking, sleeping, eating, breathing and exercising to keep the attitude of "mindfulness". The intervention plan was designed and administered by a qualified psychological expert who has been involved in MBSR treatment for 5 years. Participants in the MBSR group were divided into 4 groups with 7 people per group. Each group received training sessions for 8 weeks, and the sessions occurred once a week for one hour at a time. Each session included 10 mins of free talk (feeling about homework), 15 mins of demonstration and explanation, 20 mins of practice and guidance, and 15 mins of group imitation training. Each session was followed by homework, which was available for the trainer to understand the practice situation of each person. Combined with daily activity, the themes of the intervention were derived from "eye", "ear", "nose", "tongue", "body" and "thinking". More details of each session are listed in Table 1.

The Control Group

Students in the control group continued with their lives as usual. No specific intervention was implemented in the control group. To avoid possible overlap (contamination) with components of the MBSR programme, the students in the control group who planned to attend related associations such as yoga clubs during the intervention period (8 weeks) were excluded. After completion of the study, each student in the control group was provided with the same MBSR course according to their own wishes.

Measures

Beck Depression Inventory-II (BDI-II)

The primary outcome was the severity of depressive symptoms assessed with the BDI-II. The scale was a well-validated and widely used measure of depression that assesses the frequency of depressive symptoms over the previous 2 weeks. It consists of 21 items that are rated on a 4-point scale, with scores ranging from 0 to 63, and cut-off points of 0–13, 14–19, 20–28 and 29–63, which represent no, mild, moderate and severe levels of depression, respectively. The scale has been used in the Chinese adolescent population, revealing good reliability and validity.¹⁷

Mindful Attention And Awareness Scale (MAAS)

Participants' self-reported mindfulness level was measured with the MAAS.¹⁸ The scale contains 15 items that assess the most important characteristics of mindfulness. Items

are rated on a 6-point scale and scored as (1) almost always to (6) almost never, with higher scores reflecting a greater mindfulness state. The scale has been tested among Chinese college students, revealing good internal consistency reliability ($\alpha=0.85$) and test-retest reliability ($r=0.54$).¹⁹

Ruminative Response Scale (RRS)

The RRS was compiled by Nolen-Hoeksema and assesses the response to depression. It consists of 22 items rated on a 4-point scale that are scored as (1) never to (4) very often, with scores that ranged from 22 to 88. Higher scores represent a greater level of rumination. It has 3 factors: symptom rumination, forced thinking and introspection. The Chinese version of the Perceived Stress Scale (CPSS) was translated by Han²⁰ and has been tested among Chinese college students, revealing good internal consistency reliability ($\alpha = 0.90$) and test-retest reliability ($r=0.68-0.85$).

Procedure

After approval from the institutional review board and ethics committee, we put up a poster on campus for recruitment. The modified 8-week MBSR intervention was carried out by a qualified psychologist. The questionnaires were delivered and collected by two staff members who were independent of our study. All students completed questionnaires at three points. The first point was the initial baseline orientation when the MBSR intervention started, the second point was the end of the 8-week intervention, and the last point was 3 months after the intervention.

Statistical Methods

All data analyses were performed using IBM SPSS 21.0 (version 21.0, IBM Corp., New York, NY, United States) with bilateral inspection by two dependence assistants. The continuous variables were assessed by means with standard deviations or medians with ranges. Baseline data were compared using a *t*-test or chi-square test between the two groups. A repeated-measures analysis of variance model was used to directly test the outcomes (depression, mindfulness and rumination) between the two groups. Statistical significance was set at $p<0.05$. A *p* value of less than or equal to 0.05 was considered statistically significant.

Table 1 The MBSR Intervention Group Session Details

Week-Time	Themes	Contents	Homework	Main Problems	Solutions
1-1	Approaching mindfulness and MBSR	<ol style="list-style-type: none"> 1. Introduce each other and become familiar with each other. 2. Step into and cultivate mindfulness. 3. Introduce MBSR and the formal techniques. 	Practice mindfulness breathing every day.	Absent-minded	Never mind the distractions at the beginning of the practice. Let it be.
2-2	Eye mindfulness	<ol style="list-style-type: none"> 1. Explain the core of observing mindfulness and teach the skills to be mindfulness. 2. Teach how to focus on one's mind on the moment and without judgement 	Pick one picture to observe with mindfulness and record your feelings.	Interrupted	No judgement and no anxiety. Do your best.
3-3	Ear mindfulness	<ol style="list-style-type: none"> 1. Explain the meaning of sound mindfulness. 2. Lead the team for hearing training, feeling around sound through the waves lapping, distinguishing sound and so on to get physical and mental relaxation. 3. At the same time, learn how to experience the changes with the sounds. 	Choose a gentle song to listen with mindfulness and record your feelings.	Sneak off	Trying to focus your mind on the present moment; if you cannot, let it be.
4-4	Nose mindfulness	<ol style="list-style-type: none"> 1. Illustrate the basis of smell mindfulness and lead team members to train them how to use their nose to feel and comprehend the world. 2. Guide team members to communicate and discuss smell training. 	Choose one kind of fruit and smell with mindfulness and record your feelings.	Giving up	Practice makes perfect. Believe in your heart.
5-5	Tongue mindfulness	<ol style="list-style-type: none"> 1. Teach members how to apply mindfulness to drinking and eating. 2. Taste mineral water and an apple with 7 steps: hold, look, touch, smell, release, swallow and feel. 	Mindfulness eating training with raisins. Imagine the food source and the process when eating and record your feelings.	Emotional instability	Do not rush. Stop when in a bad state. Take a break and bring breath to this moment and keep a peaceful mind.
6-6	Body mindfulness	<ol style="list-style-type: none"> 1. Introduce body scan, which enriches the content of practice through the establishment of physical and psychological responses to stress 2. Teach appropriate yoga-based stretches, which include lying and standing postures. 	<ol style="list-style-type: none"> 1. Do body scan from head to toe. 2. According to one's own ability do mindfulness yoga. 	Disturbed by trifles	Choose a set time to practice before sleep.

(Continued)

Table 1 (Continued).

Week-Time	Themes	Contents	Homework	Main Problems	Solutions
7-7	Positive thinking	<ol style="list-style-type: none"> 1. Introduce sitting meditation and under the researchers' instruction, team members how to practice sitting meditation. 2. Put forward specific events and ask members how to think and handle the events. 3. Find out the problems and teach them how to handle things in a mindful way. 	<ol style="list-style-type: none"> 1. Do 2 hr sitting meditation 2. Try to think about one thing in your life with mindfulness and record your feelings in detail. 	<ol style="list-style-type: none"> 1. Tired 2. Cannot detect emotions during practice 	Moderate principle to practice yoga as much as you can. Focus on the process, not on the outcome
8-8	Start a new mindfulness life	<ol style="list-style-type: none"> 1. Do a summary of all the mindfulness skills and solve existing problems. 2. Meditation is a means to possess wellness were emphasize mindfulness. 3. Provide related resources to facilitate participants for further practice. 	Encourage all participants to keep practising MBSR and mindfulness in their life and in the future.	How to cultivate mindfulness in daily life	Keep the cores of mindfulness in your heart; that is, focusing on the present moment without judgement.

Results

Sociodemographic And Clinical Characteristics Of Participants

The average age of the participants was 18.94 ± 1.31 years, with a range of 17–22 years. Table 2 displays the characteristics of the two groups.

Efficacy Of MBSR On BDI, MAAS, RRS

A repeated-measures analysis of variance model was conducted to examine changes across time between the intervention and comparison conditions on measures of BDI, MAAS, RRS. Table 3 reveals descriptive statistics with mean scores of pre-post measures and significance of the group, time and time-group interactions. The results revealed a significant interaction between time and condition for BDI ($F=17.721, p<0.001, \eta^2=0.577$), MAAS ($F=13.489, p<0.001, \eta^2=0.509$), and RRS ($F=81.566, p<0.001, \eta^2=0.863$).

Discussion

This study is the first RCT pilot study to apply tailored mindfulness-based stress reduction to mental health on subthreshold depression college students to evaluate the effects of MBSR on their psychological health. Specifically, the benefits of modified MBSR on participants have been tested, such as a decrease in depression and rumination level and an increase in mindfulness state. Although researchers have been studying subthreshold depression for decades, subthreshold depression is still not recognized enough due to the lack of clear and unified diagnostic criteria, and no authoritative academic institutions have issued clear epidemiological reports.²¹ There has been little research on SD in related academic fields in China.¹⁵ Influenced by Chinese cultural values, most people are reluctant to seek psychological counselling or clinical psychotherapy, even if they have clinical symptoms that lead to an increase in the prevalence of major depression in recent years.²² Studies have shown that the incidence of subthreshold depression among adolescents has reached 30~40%.²³ Although subthreshold depression does not meet the diagnosis of a clinical depressive episode, it affects the physical and mental health of individuals; thus, it is very necessary for early intervention.²⁴

Mindfulness skills have been systematically used in psychotherapy, and related guidelines have been recommended by NICE for the treatment of depression in the UK.²⁵ However, for Chinese adolescents, the related

Table 2 Comparison Of Demographic And Clinical Characteristics Of Two Groups (n=56)

	MBSR group (n=28)	Control group (n=28)	t or χ^2	P
Age(mean±SD)	19.14±1.27	18.68±1.30	1.369 ^a	0.182
Grade			2.311 ^b	0.315
Freshman	16	20		
Sophomore	10	5		
Junior	2	3		
Residence			0.350 ^b	0.554
Country	21	19		
Rural	7	9		
Gender			0.292 ^b	0.589
Female	17	15		
Male	11	13		
Only-Child or not			1.191 ^b	0.275
Yes	22	25		
No	6	3		

Notes: ^aPresent t-test; ^bPresent χ^2 test.

Table 3 Comparison Of Two Groups On BDI, MASS And RRS

Measure	MBSR (n=28)			Control Group (n=28)			F	P	Effect Size (η^2)
	Pre Post 3 Months Mean(SD)			Pre Post 3 Months Mean(SD)					
BDI	17.00 (2.26)	14.75 (2.14)	13.43 (2.38)	16.75 (2.29)	15.93 (2.42)	16.11 (2.22)			
Time effect							44.396	0.00	0.774
Time and group effect							17.721	0.00	0.577
Group effect							5.764	0.024	0.176
MASS	51.00 (6.04)	54.53 (4.70)	56.96 (5.04)	47.18 (6.72)	47.21 (6.45)	48.96 (5.81)			
Time effect							39.080	0.00	0.75
Time and group effect							13.489	0.00	0.509
Group effect							15.006	0.01	0.357
RRS total score	49.89 (8.23)	44.14 (7.66)	41.35 (7.01)	49.11 (7.31)	48.96 (6.47)	50.04 (6.35)			
Time effect							28.277	0.00	0.685
Time and group effect							81.566	0.00	0.863
Group effect							4.585	0.041	0.145

systematic and professional psychological counselling was difficult for them to grasp in a short period of time. In this

study, we designed an eight-week simplified MBSR programme according to adolescent characteristics to examine

its effects on college students with subthreshold depression. After intervention, the results revealed that the level of mindfulness in the MBSR group increased with a mean of (51.00 ± 6.04) points, and the levels of depression increased with a mean of (54.55 ± 4.70) points. The effect sizes were significant and lasted for three months. Compared with traditional MBSR trials, the tailored MBSR combined mindfulness skills with daily life, and we summarized the main problems and provided related solutions during intervention, which were more easily accepted by students and more easily accepted for mindfulness cultivation. Previous studies have reported that when people engage in 2 hr or 2.5 hr mindfulness training, it is difficult for them to be clear and focused, and they always experience problems such as feeling sleepy, tired or disturbed.²⁶ Thus, in our study, we decreased the training time and modified the form to establish a tailored MBSR intervention to ensure feasibility. Through listening, observing, eating and smelling mindfully, participants could deal with emotions peacefully and keep a friendly attitude towards themselves, respecting their own abilities without judgement or competition. We aim to let participants grasp basic mindfulness skills through practice and gradually cultivate mindfulness into their lives. The efficacy of MBSR on depression level may be related to mindfulness training. Studies have revealed that mindfulness helps people avoid the reaction of psychological distress, which fundamentally improves their perceptions of negative events and states.²⁷ The core of mindfulness is to focus on the moment without any judgements. Mindfulness training helps individuals to consciously select and recognize thoughts, emotions and feelings but does not produce habitual reactions, which can enhance their ability to regulate emotions, thus gradually eliminating the process of automatic evaluation of negative emotions, which decrease the depression level.²⁸ Increased responsiveness and activity of the hypothalamic-pituitary-adrenal (HPA) axis and sympathetic-adrenal-medullary (SAM) system have been associated with higher levels of stress, depression and anxiety; studies hypothesize that mindfulness techniques dampen the hyperactivity of these systems, which in turns reduces the stress levels.²⁹

This study strengthens the finding of previous studies that mindfulness is an important mechanism for inhibiting rumination and preventing symptoms of depression.³⁰ Rumination is a repeated focus on our own way of thinking of negative emotions and events that impair psychological health.³¹ The results revealed that adolescents with

subthreshold depression had a high level of rumination. After 8 weeks of MBSR intervention, the rumination level decreased significantly, and this effect lasted for 3 months. Mindfulness is the conscious effort of an individual to maintain attention in the present moment and makes no judgement about it.³² Participants in the intervention group were provided with effective mindfulness skills to reduce habitual thinking and over-thinking. Through mindfulness training, our brain's daily thinking mode changes from "action mode" to "existence mode". Action mode is the inevitable product of the brain's automatic thinking. When automatic thinking becomes a habit, our consciousness will be preoccupied not with the present but with memories of the past, problems of the present, and anxieties of the future. The existence mode is a new solution to automatic thinking. It suggests that instead of being trapped in automatic thinking, subjects should focus their consciousness on the present experience and reduce the focus on oneself, which is helpful to relax the body and mind.³³ Previous studies have shown that mindfulness training reduced rumination in individuals. Teasdale et al believed that mindfulness training could relieve cognitive interlock when rumination takes place.³⁴ That is, when dealing with stress, individuals will automatically have a non-adaptive response and pay more attention to the present moment through mindfulness training, thereby promoting the transfer of attention from rumination.

Strengths & Limitations

In our research, we combined mindfulness skills with daily life based on the characteristics of adolescents, implemented them in short-term form, considered the feasibility and scientific nature, and preliminarily applied the tailored MBSR to adolescents with subthreshold depression in China. The results showed that the intervention had a positive effect on their psychological health, including alleviating symptoms of depression, decreasing rumination and cultivating mindfulness. The intervention was convenient and had a relatively long effectiveness that lasted for 3 months. Although we use double-blind in the RCT, due to the limitation of source and conditions, our study was limited by a modest sample size. Future studies should add to the sample size to confirm the effects. For future work, the intervention should be combined with other adjunctive or complementary and alternative therapies e.g. probiotic supplementation, which has been shown to alleviate depressive symptoms.³⁵ Moreover, due to limited time, the follow-up period of this study was 3 months. In our

future study, we will extend the observation time to test the long-term sustainability of the positive effects.

Conclusions

The results from this randomized controlled trial showed that modified MBSR was effective in cultivating mindfulness and reducing depressive symptom levels and rumination in adolescents with subthreshold depression. This approach is a simple and feasible intervention that promotes the psychological health of adolescent populations suffering from subthreshold depression.

Ethical Approval And Consent To Participate

The University of Institutional review board approved this study (No.2017-10) and informed consent was obtained from every participant.

Consent For Publication

Informed consent for the publication of these have been obtained from all participants. All the students have signed for agreement. The parent or legal guardian provided written informed consent for any participant under the age of 18 years.

Data Sharing Statement

The data used to support the findings of this study are available from the corresponding author upon request.

Acknowledgments

The authors were grateful for all the participants in this study for their cooperation and all the clinical staff for providing the intervention place and the assistance with data collection. This work was supported by the grant of Science Foundation of Ministry of Education of China [No.17YJCZH241] and the Fundamental Research Funds for the Provincial Universities [No.2018wld-02]. Jia-Yuan Zhang and Xiang-Zi Ji are co-first authors.

Disclosure

The authors report no conflicts of interest in this work.

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