Psychiatry Research 281 (2019) 112571

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Short communication

Mindfulness-based stress reduction improves the general health and stress of Chinese military recruits: A pilot study

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ABSTRACT

This paper reported the health effects of mindfulness-based stress reduction (MBSR) among 49 Chinese military recruits with psychological distress in a 12-week study. Participants were randomized into a MBSR and a waitlist group. Previously validated questionnaires were administered to both groups at four time points: baseline, 5, 8, and 12 weeks after participation. Compared to the waitlist group, the MBSR group showed more improvements in mindfulness and general health, as well as more stress reduction at 12-week follow-up. This study suggested that MBSR could be a promising health intervention for improving general health and reducing stress in Chinese military recruits.

1. Introduction

Military personnel face multiple stressors during their service time (Hourani et al., 2006). This is especially true for new recruits who are making the transition to the military environment. In addition to psychological distress, health consequences resulting from high levels of stress, such as obesity (Kuo et al., 2007), backache (Violante et al., 2005), and coronary heart disease (Bunker et al., 2003; Kivimäki et al., 2006), may impair the performance of military recruits and add a financial burden associated with treatment. Therefore, it is essential and urgent to search for an intervention that strengthens psychological resilience among recruits to help them buffer stress.

Emerging evidence has suggested the efficacy of mindfulness-based interventions (MBIs) in alleviating stress and improving general well-being (Kaplan et al., 1993; Carlson et al., 2001; Chang et al., 2004; Khoury et al., 2015). A well-established MBI is mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1982), which is an 8-week program that incorporates yoga, body scanning, and sitting meditation into weekly group courses to help with stress reduction, pain alleviation, and other psychological concerns, such as anxiety and depression (Grossman et al., 2004; Hofmann et al., 2010; Kabat-Zinn et al., 1985). Although positive results of MBSR have been reported in a variety of clinical and nonclinical populations (Chiesa and Serretti, 2009; Cramer et al., 2012; Eberth and Sedlmeier, 2012; Sharma and Rush, 2014; Smith et al., 2005), to our knowledge, no study has addressed its efficacy in Chinese military recruits.

Thus, the current study aimed to investigate the feasibility, acceptability, and efficacy of MBSR in a group of newly recruited Chinese military recruits. We expected to find stress reduction and general health improvement as a result of the MBSR.

2. Methods

2.1. Participants

The study was approved by the ethical committees of Second Military Medical University in Shanghai. Participants (n = 410) were recruited from a primary army unit of the Chinese People's Armed Police Force (CAPF). Inclusion criteria were: 1) recruits enlisted within the past week; and 2) scoring 4 or above in the General Health Questionnaire-12 (GHQ-12). Exclusion criteria were: 1) having meditative experience; and 2) currently receiving mental health care. After screening, 49 qualified participants were invited to a baseline mental health check-up. Participants were informed of voluntary participation and withdrawal, as well as confidentiality. Informed consent was obtained before participation. SPSS (SPSS Inc, 1999) was used to generate a random sequence of numbers that were then used to group the participants into the MBSR group (n = 30) or a waitlist group (n = 19).

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https://doi.org/10.1016/j.psychres.2019.112571
Received 15 July 2019; Received in revised form 17 September 2019; Accepted 17 September 2019
Available online 18 September 2019
0165-1781/

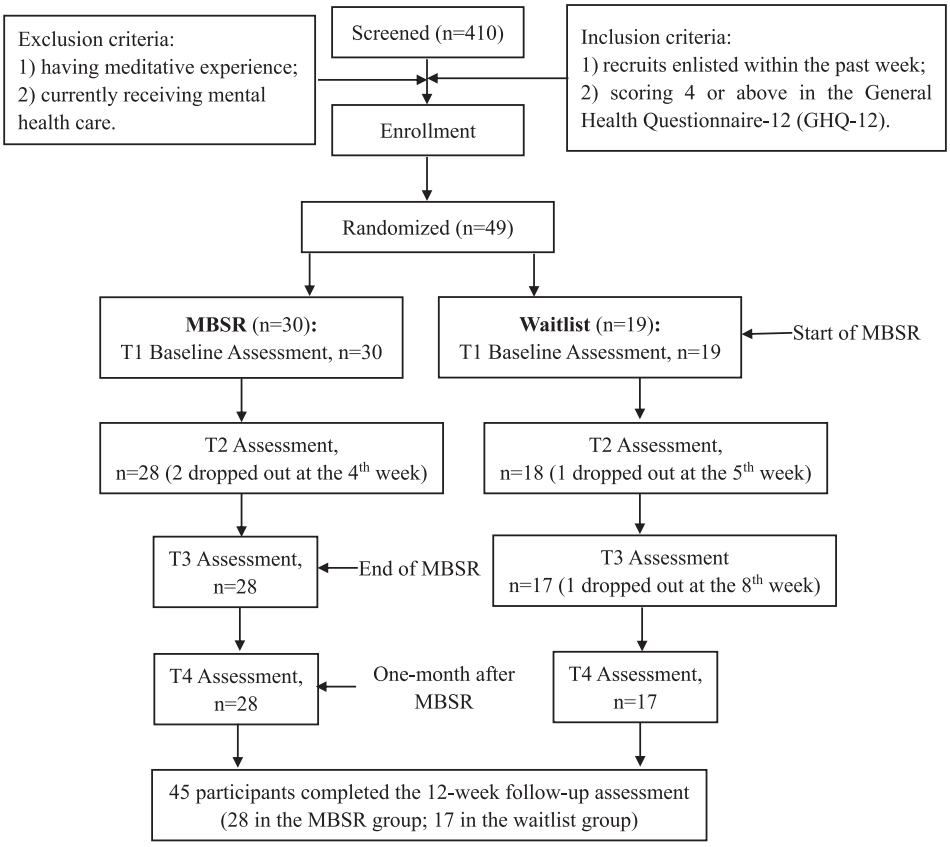

Fig. 1. Flowchart of study procedures.

Following the recommendation of Possemato (2016), participants were randomized with a ratio of 3:2. Four participants dropped out due to physical disease, with 2 from the MBSR (6.7%) and 2 from the waitlist group (10.5%), resulting in a total of 45 participants completing the study. Fig. 1 depicts the flow of participants through recruitment and each stage of the study.

2.2. Intervention

MBSR is a well-established mindfulness training program that runs for 8 weeks with weekly, 2-h group training sessions and an additional full-day retreat session during the sixth week. The curriculum was delivered to participants by a certified instructor with long-term training experience of MBSR. Furthermore, each session provided an opportunity for participants to share their experiences with mindfulness practice during the last week. Participants were also assigned a 45-min homework exercise, which is an essential component of the program. Exercises include mindfulness practice in a formal manner (e.g., body scan, sitting meditation, and yoga) and in an informal manner (e.g., eating, cleaning, and other daily activities). Participants were required to keep a daily practice record throughout the intervention.

2.3. Measures

The demographic measure was designed to collect participant information, such as age, education status, and religion. Additionally, three self-report questionnaires were administered to participants at baseline, 5, 8, and 12 weeks after enrollment. General health was measured by the GHQ-12, which was based on Goldberg's General Health Questionnaire and was translated to Chinese by Cheng (Goldberg et al., 1997; Cheng et al., 1990). Items were recorded (0–0–1–1) and summed to provide a total score, with a score ≥ 4 indicating psychological distress (The Scottish Health Survey, 1998; Jair and Paul, 1985; Ting-Zhong and Li, 2003). A higher score of the GHQ-12 indicates a higher degree of psychological distress, that is, worse general health. The Cronbach's alpha in this study was 0.76. Stress was measured by the Chinese version of the Perceived Stress Scale 10 (PSS-10). Higher scores on the PSS-10 indicate greater perceived stress. For this study, items evidenced good internal consistency ($\alpha = 0.83$). Mindfulness was included as a potential mediator of the intervention effect and was measured by the Chinese version of the Five Facets of Mindfulness Questionnaire (FFMQ; Baer et al., 2006). For this study, Cronbach's alpha coefficient was 0.93. Additionally, homework compliance was assessed weekly by checking practice records.

At the end of the study, participants were asked the following questions to assess program efficacy:

"Do you think MBSR is suitable for soldiers";

"Do you think MBSR is effective in reducing stress and improving general health";

"What is the weakness of MBSR if it is applied to the military."

2.4. Statistical analysis

The design of study was a longitudinal randomized controlled trial with repeated measures of outcome variables across four time points. First, differences in baseline characteristics were examined between the two groups. Next, two-way repeated measures analysis of variance (ANOVA) was performed for each outcome measurements with time points (T1, T2, T3, T4) as a within-subjects factor and group (MBSR and Waitlist) as a between-subjects factor. Correlational analyses were conducted to examine the relationships between mindfulness and other outcome variables.

Table 1
Demographic comparisons of participants in the MBSR and Waitlist Group.

Characteristic	MBSR (n = 28) n (%) or M ± SD	Waitlist (n = 17) n (%) or M ± SD	$\chi^2(t)$	p
Age	19.00 ± 1.333	18.88 ± 0.993	−0.314	0.76
Only child			0.932	0.33
Yes	11 (39.3%)	10 (58.8%)		
No	17 (60.7%)	7 (41.2%)		
Census register			0.160	0.69
Town	7 (25.0%)	6 (35.3%)		
Countryside	21 (75.0%)	11 (64.7%)		
Education status			1.954	0.38
Below high school	4 (14.3%)	4 (23.5%)		
High school	16 (57.1%)	11 (64.7%)		
Above high school	8 (28.6%)	2 (11.8%)		
Religion			1.368	0.50
None	25 (89.3%)	16 (94.1%)		
Buddhism	2 (7.1%)	0		
Christianity	0	0		
Islamism	1 (3.6%)	1 (5.9%)		
Other	0	0		
Occupation before joining the army			1.462	0.69
Student	17 (60.7%)	11 (64.7%)		
Worker	5 (17.9%)	4 (23.5%)		
Wait for employment	5 (17.9%)	1 (5.9%)		
Other	1 (3.6%)	1 (5.9%)		
Satisfaction in the army			0.527	0.47
Voluntary	25 (89.3%)	13 (76.5%)		
Involuntary	3 (10.7%)	4 (23.5%)		

Note: MBSR, mindfulness-based stress reduction.

3. Results

3.1. Sample characteristics

All participants were male (mean age 18.96 ± 1.21SD). Differences in the demographic characteristics between the two groups was examined using either χ^2 or t-tests (Table 1). No significant difference in the baseline demographic characteristics was observed between the MBSR and the waitlist group.

3.2. Change in mindfulness

Two-way repeated measures ANOVA revealed a significant main effect of group ($F(1,43) = 8.77$, $p < 0.01$) and time ($F(1,43) = 2.98$, $p < 0.05$) for mindfulness measured by FFMQ (Table 2). The MBSR group scored higher in mindfulness than the waitlist group, and mindfulness increased throughout the intervention. The significant time × group interaction ($F(1,43) = 3.28$, $p < 0.05$) indicated that the MBSR group experienced a larger increase in mindfulness when compared to the waitlist group.

3.3. Change in general health and stress

The change of general health and stress scores between the MBSR and the waitlist group is presented in Tables 3.1 and 3.2. Two-way repeated measures ANOVA examining the scores of general health revealed a significant main effect of group ($F(1,43) = 6.685$, $p < 0.05$) and time ($F(1,43) = 20.405$, $p < 0.01$), indicated better general health in the MBSR group and general health was improving throughout the intervention, respectively. The significant effect of time x group interaction, $F(1,43) = 4.593$, $p < 0.01$, indicating more improvement in general health in the MBSR than the waitlist. Two-way repeated measures ANOVA examining the scores of stress also showed a significant main effect of group ($F(1,43) = 4.157$, $p < 0.05$) and time ($F(1,43) = 3.756$, $p < 0.05$), indicating that the MBSR group has a lower level of stress than the waitlist and stress was progressively decreasing throughout the intervention. There was no significant time × group interaction effect, $F(1,43) = 2.768$, $p = 0.056$.

3.4. Correlation between mindfulness and psychological outcomes

We examined whether mindfulness was related to general health and perceived stress. Table 4 presented the correlations between scores of mindfulness and other outcome variables at each time point. All correlations were significant except the correlation between mindfulness scores and general health scores measured at T4 ($p = 0.09$). The significant correlations suggested that mindfulness scores were negatively associated with general health scores and stress scores. As mentioned above, higher scores of GHQ-12 represent worse general health and higher scores of PSS-10 represent greater level of stress; therefore, the results suggested that higher mindfulness was related to better general health and lower stress at each time point. Concerning the reason for the non-significant correlation between mindfulness and general health at T4, the small sample size could have prevented finding a significant effect. Besides, it could be that MBSR had a more specific effect on stress reduction than on general health, in view that mindfulness was associated with stress reduction throughout the entire 12-week MBSR program.

3.5. Subject acceptance

During the final session of MBSR, participants completed a course evaluation containing open-ended questions regarding strengths and weaknesses of the MBSR intervention. The efficacy of MBSR with Chinese military recruits was also examined. Overall, 44.9% of participants reported the MBSR program suitable for soldiers and 53.1% reported the program useful for reducing stress and improving health. Subject responses to the open-ended question were also reviewed for future development of MBSR programs in the military. Representative responses to the question including:

"The length of practice is too long", "It is common to find oneself mind wandering during the mindfulness practice".

Table 2
Scores of mindfulness across four time points for the MBSR and the Waitlist Group.

Mindfulness scales	FFMQ (mean, SD) T1	T2	T3	T4	Main effects ($F_{(1,43)}$) Group	Time	Interaction ($F_{(1,43)}$) Time × group
MBSR (n = 28)	114.46 (2.34)	121.32 (2.55)	127.25 (2.35)	122.00 (2.47)	8.770**	2.978*	3.276*
Waitlist (n = 17)	112.29 (3.00)	111.82 (3.27)	111.59 (3.57)	115.12 (3.16)			

Note: FFMQ, Five Facets of Mindfulness Questionnaire; MBSR, mindfulness-based stress reduction; T1, baseline; T2, 5-week follow-up; T3, 8-week follow-up; T4, 12-week follow-up.
* $p < 0.05$.
** $p < 0.01$.

Table 3.1
Scores of general health across four time points for the MBSR and the Waitlist Group.

Mindfulness scales	GHQ-12 (mean, SD)				Main effects ($F_{(1,43)}$)		Interaction ($F_{(1,43)}$)
	T1	T2	T3	T4	Group	Time	Time × group
MBSR (n = 28)	5.61 (2.06)	2.57 (2.92)	0.96 (1.00)	1.96 (2.25)	6.685*	20.405**	4.593**
Waitlist (n = 17)	5.29 (1.49)	3.12 (2.15)	3.88 (2.78)	3.06 (2.73)			

Note: GHQ-12, General Health Questionnaire-12; MBSR, mindfulness-based stress reduction; T1, baseline; T2, 5-week follow-up; T3, 8-week follow-up; T4, 12-week follow-up.
* $p < 0.05$.
** $p < 0.01$.

Table 3.2.
Scores of perceived stress across four time points for the MBSR and the Waitlist Group.

Mindfulness scales	PSS-10 (mean, SD)				Main effects ($F_{(1,43)}$)		Interaction ($F_{(1,43)}$)
	T1	T2	T3	T4	Group	Time	Time × group
MBSR (n = 28)	31.89 (1.55)	27.25 (1.45)	23.71 (1.49)	25.64 (1.37)	4.157*	3.756*	2.768
Waitlist (n = 17)	31.41 (1.99)	29.53 (1.86)	31.47 (1.91)	29.00 (1.76)			

Note: MBSR, mindfulness-based stress reduction; PSS-10, Perceived Stress Scale-10; T1, baseline; T2, 5-week follow-up; T3, 8-week follow-up; T4, 12-week follow-up.
* $p < 0.05$.

4. Discussion

The current study was the first to extend MBSR to Chinese military recruits and found positive effects (e.g., general health improvement and stress reduction). The results showed that mindfulness was related to the improvement in general health and reduction in stress, suggesting that mindfulness could play a central role in improving the health of Chinese military recruits. Likewise, others have also found similar effects in military population across other nations (Büssing et al., 2013; Elizabeth et al., 2011; Johnson et al., 2014; Pamela et al., 2013). Surprisingly, the withdrawal rate in this study was lower than previous similar studies (Deckersbach et al., 2006; Wilhelm et al., 2012), which could be due to the high satisfaction level and relaxation effect reported by participants in this study. Together, these findings suggested that MBSR could be a feasible, effective, and acceptable health intervention for Chinese military recruits.

Although the current study extended the application of MBSR to a population with high risk of stress, the underlying mechanism through which MBSR produces the health effects remains unclear. Mindfulness is paying attention to the moment-to-moment experience with an accepting and nonjudgmental attitude (Bishop et al., 2004; Grossman et al., 2004; Kabat-Zinn, 1990), which may contribute to regulating emotional disturbance associated with stress. Future studies may benefit from mediation analyses in a larger sample. Moreover, the current findings have important implications to a military cohort given that better ability to cope with stress can improve performance in physical activities (Solberg, 1996). For example, a recent meta-analytic review with 290 healthy sportive participants reported improved performance outcomes in shooting and dart throwing following mindfulness practice (Bühlmayer et al., 2017). Given the intense physical training in military recruits, it could be potentially fruitful to examine the impact of mindfulness on physical performance adaptations during military training.

4.1. Strengths and limitations

The pilot study exhibited several strengths. First, it contributed to the small number of studies examining the feasibility and efficacy of MBI in military, and it might be the first study of its kind in CAPF recruits. Second, the participant population was homogeneous, and the dropout rate was low.

The study is not free of limitations. First, the sample size is small (a total of 49 participants). Second, due to the challenges in the measurement of mindfulness, data regarding mindfulness were self-reported by the participants. Third, only a one-month follow-up was conducted after the MBSR program, making it difficult to determine whether MBSR has a long-term effect on general health and stress reduction for recruits.

4.2. Conclusions and future directions

The present study demonstrated the feasibility to deliver an 8-week MBSR program in a group of Chinese military recruits, and showed positive effects, including increased mindfulness, improved health, and reduced stress. As the intervention progressed, participants reported increase in mindfulness, as well as improved general health and reduced stress. A significant correlation between mindfulness, general health, and stress was also observed, suggesting that increase in mindfulness might mediate the MBSR program and positive effects in general health and stress. Furthermore, the feasibility, efficacy, and acceptability found in the present study demonstrated that MBSR could be an effective and cost-efficient program to strengthen psychological resilience in military recruits. Future studies should evaluate the effectiveness of MBSR in a larger sample of military recruits and explore

Table 4
Correlation of mindfulness and other outcome variables at each time point.

	FFMQ							
	T1		T2		T3		T4	
2	Correlation	p	Correlation	p	Correlation	p	Correlation	p
PSS-10	−0.478	0.001	−0.422	0.004	−0.712	0.000	−0.534	0.000
GHQ-12	−0.366	0.013	−0.505	0.000	−0.355	0.017	−0.256	0.090

Note: FFMQ, Five Facets of Mindfulness Questionnaire; GHQ-12, General Health Questionnaire-12; PSS-10, Perceived Stress Scale-10; T1, baseline; T2, 5-week follow-up; T3, 8-week follow-up; T4, 12-week follow-up.

the effect of mindfulness-based interventions on physical performance in military recruits.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Shanghai Pujiang Program(13PJC003); innovation program of Shanghai Municipal Education Commission (14ZS084).

Declaration of Competing Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Acknowledgement

The authors would like to acknowledge the volunteers who participated in the study and the Meditation Foundation for delivering the meditation program.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.112571.

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