



Intervention Effect of Mindful Self-Compassion Training on Adolescents' Psychological Stress during the Pandemic

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Abstract

Background: COVID-19 has been confirmed as a public health emergency and may give rise to adverse emotions such as anxiety and fear, and even stress reactions in serious cases. In a critical period of emotional development, adolescents experience more psychological stress fluctuations. Mindful self-compassion training is a simple and easy psychological assistance technology that has been recognized as effective, but it has not been applied to adolescents' psychological problems caused by the epidemic.

Methods: From September 2021 to January 2022, adolescent volunteers were recruited in this study from four communities in Chongqing, China. A total of 107 adolescents volunteered to participate in this intervention experiment and were divided by the table of random numbers into 53 in the experiment group and 54 in the control group. The experiment group was intervened using mindful self-compassion training in combination with aerobic exercise for two months, while no intervention measures were taken in the control group. Stress Appraisal Measure, Profile of Mood States and Pittsburgh Sleep Quality Index were the scales adopted to evaluate the effect before and after the intervention.

Results: The experimental group had significantly lower negative mood, stress, sleep scores than the control group ($P < 0.001$) and significantly higher differences before and after treatment than the control group ($P < 0.001$).

Conclusion: The intervention in this study can effectively reduce the level of negative mood and stress in individuals, and improve their vitality and sleep quality and provides new insights for the implementation and improvement of psychological assistance technology.

Keywords: Mindful self-compassion; Adolescents; Psychological stress; COVID-19

Introduction

Adolescence is a critical period of individual emotional development. On the whole, emotional development in this period is characterized with being vulnerable to external conditions and events, being easily troubled by negative mood,

and higher level of fluctuations in psychological stress (1). It has been shown in an investigation that severe traumatic events often lead to a persistent decline of adolescents' mental health (2). As a sudden social public health event, COVID-



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19 has not only led to disorder in society, but also affected the normal learning and lifestyle of adolescents (3). It has been revealed that adolescents have experienced changes in their psychological state, mood and stress during the pandemic (4). Individuals may have adverse emotions such as anxiety and fear, and even somatization symptoms such as insomnia, palpitation, chest tightness, etc. when they are seriously affected. However, in the period after the outbreak of COVID-19, the pandemic has not completely disappeared as expected. It is still impossible to obtain full-range recovery. Instead, the pandemic may break out in a small scale at any time and would last for a long time, thus having a far-reaching impact on all aspects of society (5).

Magson et al. (6) divided the factors affecting adolescents' mental health into protective factors and risk factors. It has been pointed out in their study that peer support is an important protective factor to reduce the occurrence of mental health problems and alleviate psychological stress, while at-home isolation and online learning difficulties are risk factors that aggravate their psychological stress. It has been further indicated in the research by Zhen et al. (7) that social independence, unsatisfied psychological needs, and less self-disclosure are risk factors that affect adolescents' psychological stress. These studies show that there are comprehensive factors affecting adolescents' mental health in the post-pandemic era. In addition, more and more researchers have begun to carry out external intervention on adolescents' mental health under the guidance of relevant theories. These methods have certain intervention effects, but a single intervention method may yield only limited effects. Meanwhile, there are few interventions that focus on alleviating adolescents' psychological stress under the background of COVID-19.

Self-compassion, also known as self-pity, means that individuals maintain amity towards the hardships they encounter, treat their own shortcomings with an understanding and non-critical attitude and can also raise their own experience to the level of being a part of common human experience that includes self-friendliness, universal

humanity and mindfulness (8). Self-compassion has been proved to play an important role in coping with external negative events, and interventions based on self-compassion often bring favorable psychological effects (9). The research results obtained by Kavakli et al. (10) show that self-compassion can buffer individuals' perceived threat of COVID-19 and reduce their anxiety about death. At the same time, it has been suggested by Chen and Wang (11) that self-compassion is the main influencing factor that gives rise to stress, which can be relieved by improving the level of self-compassion in individuals. Nevertheless, so far, there is no intervention study on adolescents' psychological stress state that focuses on self-compassion. On the basis of previous studies, self-compassion training was combined with aerobic exercise in this study to intervene in the psychological stress state of adolescents with serious emotional problems. It is expected that this experiment can further innovate and expand the research of Self-compassion Theory, and provide objective evidence and data on how to deal with the stress caused by major health events and alleviate a series of negative psychological problems.

Materials and Methods

One hundred and ten adolescent volunteers were recruited in this study from four communities in Chongqing, China. Those who did not participate in group psychological counseling for two consecutive months, or who took part in individual psychological counseling while receiving group psychological counseling were considered to drop out of the study. Finally, 53 members in the experiment group and 54 in the control group completed this study. The survey was conducted in May 2020, during which the pandemic was basically controlled and working and schooling were gradually recovered in all regions of China. Public recruitment was adopted in this study to include those who were willing to participate and committed to abide by the group settings; the negative affect subscale of Profile of Mood States

was used to select the objects with high scores. One hundred and seven volunteers were involved in the study after an interview survey, stratified by gender and randomly divided into the experiment group and the control group. The average age of the adolescents participating in the intervention, including 52 boys and 55 girls, and 56 junior high school students and 51 senior high school students, was 12.34 years (SD=5.41).

The volunteers of this study were informed of the research content, purpose and main methods, and the copies of the questionnaire were filled in anonymously. Consent was obtained from the volunteers. The study met the criteria of the Ethics Committee.

Research tools

The data to be collected and measuring instruments of the survey were discussed and determined by the researchers. The target data includes demographic information, psychological stress, sleep and negative mood in the post-pandemic period. Among them, psychological stress was assessed with Stress Appraisal Measure; negative mood was assessed with Profile of Mood States; sleep was assessed with Pittsburgh Sleep Quality Index (PSQI). All these scales are self-rating scales.

Profile of Mood States (POMS) (12): This scale contains 65 items or adjectives in 6 subscales. A higher score on each of the first 5 subscales means that the mood is worse (the negative affect subscale), while a higher score in energy-vitality suggests the opposite (the positive affect subscale). The 6 subscales have high internal consistency and test-retest reliability. This study was conducted to detect the impact of the pandemic on adolescents' mood. Therefore, the negative affect subscale of Profile of Mood States was employed to measure the score in tension-anxiety, depression-dejection, anger-hostility, fatigue-dullness, confusion-chaos and energy-vitality. The test-retest reliability coefficient of POMS is between 0.406 and 0.664, and the α coefficient is between 0.705 and 0.890, indicating that the scale has satisfactory reliability and validity.

Pittsburgh Sleep Quality Index (PSQI) (13): It contains a total of 18 items in 7 dimensions, including subjective sleep quality, sleep latency, sleep time, sleep efficiency, sleep disorders, hypnotic drugs and daytime dysfunction. A higher score suggests worse sleep quality.

Stress Appraisal Measure (SAM) (14): The scale is often used to measure individual cognition in stress events. It is divided into two dimensions, namely self-control and other-control, with a total of 8 items rated by 1-5 points. A higher score suggests stronger self-control ability and weaker stress response.

Procedure

All the participants were measured with Profile of Mood States (POMS), Pittsburgh Sleep Quality Index (PSQI) and Stress Appraisal Measure before and after the intervention to detect the effect of this intervention. In particular, the participants in the experiment group received mindful self-compassion training for two months, once a week, 50 minutes each time, in combination with aerobic exercise. The control group did not receive any intervention.

Intervention methods for the experiment group

Mindful self-compassion (MSC) training: MSC covers three aspects, namely self-friendliness, mindfulness, and universal humanity, including all kinds of meditation (such as compassion training, mindfulness breathing) and informal practices in daily life (such as soothing touch, writing self-compassion letters, etc.) (15). The experience exercises in the course aim to induce self-compassion in the participants, make everyone feel connected with others, and help them develop the habit of self-compassion. The main content is as follows: the first week of training is mainly about the acquaintance among team members and the introduction of Self-compassion Theory. The purpose of the second week of training is to lead the participants to capture the thoughts and feelings in mind and preliminarily experience mindfulness. The third week of mindful self-compassion training is to develop

individual compassion and pity, so as to better foster self-sympathy. The fourth week is focused on the use of the three parts of self-compassion to hint the individuals, and to induce their emotional change by changing their internal thinking. In week 5, they are encouraged according to the knowledge background of the pandemic to form a healthier self-concept. The activities in weeks 6-7 are to apply the skills of self-compassion to daily life and deal with emotional and interpersonal problems encountered in daily life. The eighth week of training is to attach self-friendliness, universal humanity and mindfulness to fantastic and positive parts, that is, self-appreciation. While being able to actively cope with painful experience in life, they can also notice the beautiful aspects of life and experience a better life.

Aerobic exercise on the basis of mindful self-compassion training: In consideration of the possible recurrence of the pandemic, group exercise was not set in this study. Instead, free medium- and long-distance running was selected as the exercise method, four times a week, more than 30 minutes each time. Medium and long-distance running data is recorded with the function of running clock-in on the app “Sports World Campus”. The recording principle is: during the intervention period, each student needs to

finish the task of running at least an average of 15 km every week. In other words, they need to complete medium- and long-distance running exercise at least 4 times every week, so as to ensure that their engagement in regular and sufficient medium- and long-distance running.

Statistical methods

SPSS 21.0 software was used for statistical analysis. The measurement data of normal distribution was expressed in ($\bar{x} \pm s$) and t-test was adopted; the measurement data of non-normal distribution was expressed in [M (P25, P75)], and non-parametric test was adopted; The count data was expressed in percentage (%), and χ^2 test was adopted, with the difference being statistically significant when $p < 0.05$.

Results

Demographic information statistics

The demographic comparison between the experiment group and control group is shown in Table 1. No significant differences in gender and age were found between the control and intervention groups.

Table 1: Comparison of demographic information between experiment group and control group

| Variable | | Control group (n=24) | Experiment group (n=25) | Statistics | P value |
|----------|--------|-------------------------|-------------------------|---------------|---------|
| Age (yr) | | 12.33±0.89 | 12.98±0.79 | t=0.97 | 0.49 |
| Gender | Male | 11 | 10 | $\chi^2=0.39$ | 0.67 |
| | Female | 13 | 25 | | |

Comparison of adolescents' mood before and after the intervention

It can be seen from Table 2 that there were no significant differences between the experiment group and the control group in all dimensions of negative mood and the dimension of vitality before the intervention, suggesting that the two groups are comparable at baseline. However, after the intervention, the experiment group had significant decreases in various dimensions of

negative mood, including tension-anxiety, depression-dejection, anger, fatigue and confusion, and a significant increase in the dimension of vitality. In addition, the experiment group had more significant improvement in negative mood and vitality than the control group after the intervention. It is worth noting that the control group without intervention had a significant increase in the dimension of fatigue after the intervention.

Table 2: Statistical negative mood scores of adolescents in the experiment group and the control group before and after the intervention

| <i>Variable</i> | | <i>Control group (n=24)</i> | <i>Experiment group (n=25)</i> | <i>t/p</i> |
|----------------------|---------------------|---------------------------------|------------------------------------|-------------|
| Tension-anxiety | Before intervention | 3.12±0.39 | 3.05±0.34 | 0.73/0.46 |
| | After intervention | 2.26±0.60 | 3.06±0.48 | -5.11/0.001 |
| | t/p | 6.05/0.001 | -0.07/0.95 | |
| Depression-dejection | Before intervention | 3.10±0.35 | 2.94±0.39 | 1.53/0.13 |
| | After intervention | 1.86±0.51 | 2.92±0.39 | -8.00/0.001 |
| | t/p | 9.56/0.001 | 0.13/0.89 | |
| Anger | Before intervention | 2.86±0.34 | 2.96±0.47 | -0.88/0.38 |
| | After intervention | 1.88±0.54 | 2.92±0.39 | -8.94/0.001 |
| | t/p | 7.74/0.001 | -0.49/0.62 | |
| Fatigue | Before intervention | 2.96±0.41 | 2.95±0.37 | 0.16/0.86 |
| | After intervention | 2.04±0.45 | 3.20±0.40 | -9.42/0.001 |
| | t/p | 7.81/0.001 | -2.57/0.01 | |
| Confusion | Before intervention | 3.00±0.37 | 3.06±0.36 | -0.75/0.46 |
| | After intervention | 1.91±0.62 | 2.98±0.41 | -7.11/0.001 |
| | t/p | 6.95/0.001 | 0.77/0.44 | |
| Vitality | Before intervention | 1.21±0.74 | 1.34±0.76 | -0.58/0.56 |
| | After intervention | 3.42±0.28 | 1.09±0.39 | 25.68/0.001 |
| | t/p | -14.69/0.001 | 1.30/0.21 | |

Comparison of adolescents' stress before and after the intervention

It can be seen from Table 3 that there were no significant differences between the experiment group and the control group in the two dimensions of self-control and other-control before the intervention, indicating that the two groups were comparable at baseline. After the intervention,

the experiment group had significant improvement in self-control and other-control, and the control group also had significant improvement in these two dimensions. Noticeably, the improvement degree of the experiment group was significantly higher than that of the control group.

Table 3: Statistical stress scores of adolescents in the experiment group and the control group before and after the intervention

| <i>Variable</i> | | <i>Control group (n=24)</i> | <i>Experiment group (n=25)</i> | <i>t/p</i> |
|-----------------|---------------------|---------------------------------|------------------------------------|------------|
| Self-control | Before intervention | 2.07±0.50 | 2.08±0.39 | -0.10/0.92 |
| | After intervention | 3.61±0.48 | 2.44±0.56 | 7.73/0.001 |
| | t/p | -11.14/0.001 | -2.67/0.013 | |
| Other-control | Before intervention | 1.97±0.56 | 1.89±0.36 | 0.54/0.59 |
| | After intervention | 3.48±0.59 | 2.50±0.54 | 5.95/0.001 |
| | t/p | -9.12/0.001 | -5.15/0.001 | |

Comparison of adolescents' sleep quality before and after the intervention

It can be seen from Table 4 below that there were no significant differences between the experiment group and the control group in all dimensions of sleep quality before the intervention, indicating that the two groups were comparable at baseline. After the intervention, the experiment group had significant improvement in subjective sleep quality, sleep time, sleep efficiency, sleep

disorders and hypnotic drugs, but had no significant improvement in sleep latency and daytime dysfunction; except for no significant change in the dimension of sleep time, the control group had significant improvement in all other dimensions after the intervention. However, the improvement degree of the experiment group in sleep quality after the intervention was significantly higher than that of the control group.

Table 4: Statistical sleep scores of adolescents in the experiment group and the control group before and after the intervention

| <i>Variable</i> | | <i>Control group (n=24)</i> | <i>Experiment group (n=25)</i> | <i>t/p</i> |
|--------------------------|---------------------|---------------------------------|------------------------------------|-------------|
| Subjective sleep quality | Before intervention | 2.45±0.36 | 2.37±0.41 | 0.71/0.48 |
| | After intervention | 1.08±0.45 | 1.95±0.55 | -6.11/0.001 |
| | t/p | 11.84/0.001 | 2.69/0.01 | |
| Sleep latency | Before intervention | 2.48±0.33 | 2.35±0.49 | 1.03/0.35 |
| | After intervention | 2.16±0.75 | 2.25±0.75 | -0.46/0.64 |
| | t/p | 1.85/0.07 | 0.62/0.54 | |
| Sleep time | Before intervention | 2.42±0.34 | 2.54±0.44 | -1.11/0.27 |
| | After intervention | 1.22±0.54 | 2.02±0.65 | -4.78/0.001 |
| | t/p | 9.53/0.001 | 3.08/0.005 | |
| Sleep efficiency | Before intervention | 2.52±0.39 | 2.58±0.41 | -0.55/0.58 |
| | After intervention | 0.96±0.33 | 1.96±0.62 | -5.43/0.001 |
| | t/p | 9.36/0.001 | 3.49/0.002 | |
| Sleep disorders | Before intervention | 2.49±0.38 | 2.58±0.31 | -0.89/0.37 |
| | After intervention | 0.98±0.47 | 1.91±0.38 | -7.51/0.001 |
| | t/p | 11.17/0.001 | 7.83/0.001 | |
| Hypnotic drugs | Before intervention | 2.56±0.28 | 2.51±0.31 | 0.53/0.59 |
| | After intervention | 0.85±0.37 | 2.04±0.50 | -9.40/0.001 |
| | t/p | 21.31/0.001 | 4.10/0.001 | |
| Daytime dysfunction | Before intervention | 2.28±0.39 | 2.45±0.33 | -1.70/0.09 |
| | After intervention | 1.88±0.71 | 1.98±0.55 | -0.58/0.56 |
| | t/p | 2.68/0.001 | 3.82/0.001 | |

Discussions

Analysis of the intervention effect of mindful self-compassion training in combination with aerobic exercise on adolescents' negative mood

According to the results of this study, the scores of the experiment group and the control group in negative mood and vitality are at the same baseline level before the intervention. On the whole,

the intervention model established in this study can effectively reduce the tension-anxiety, depression-dejection, anger, fatigue and confusion of the participants in the experiment group and significantly improve the vitality level of the experiment group, but this intervention effect is not observable in the control group. This research result is consistent with the meta-analysis results obtained by Geurtzen et al. (16). First of all, Self-compassion Theory believes that individuals with

a high level of self-compassion tend to have self-tolerance, self-understanding and other similar positive attitudes. Such positive attitudes can expand their cognitive scope and increase their psychological resources that are useful for them to better cope with pressures from the external environment (17). As found in this study, mindful self-compassion training can improve adolescents' awareness of COVID-19 as a public health emergency and get to know that most people are also negatively affected by the event like them. They are not isolated and helpless since their suffering is not a single case. In this situation, they would have a higher level of self-compassion, correctly treat their frustration caused by the pandemic, and embrace their imperfections, thereby reducing their depression, anxiety, fatigue and anger. Moreover, the intervention methods in this study can also significantly promote the level of vitality in adolescents. This research result is basically consistent with the finding obtained by Béland et al. (18). The positive effect of self-compassion can effectively enhance individuals' psychological resources and thereby improve vitality in adolescents. Meanwhile, aerobic exercise has been added to mindful self-compassion training in this study. It has been shown in previous studies that aerobic exercise can effectively wake up individuals' positive mood and relieve their negative mood, which is consistent with the results of many previous relevant studies.

Analysis of the intervention effect of mindful self-compassion training in combination with aerobic exercise on adolescents' stress

According to the results of this study, there are no statistical differences between the experiment group and the control group before the intervention in the two dimensions of stress. After the intervention, the experiment group has significant improvement in self-control and other-control, at a degree significantly higher than that of the control group. This result shows that the intervention model in this study can effectively reduce adolescents' psychological stress level and enhance their sense of self-control. This research result is similar to the intervention results ob-

tained by Gross and Cassidy (19). The main reason lies in the essential nature of psychological stress as a depletion state in which internal psychological control resources cannot cope with external emergencies and negative events. The strength model of self-control indicates that a person's self-control resources are limited. If the former activity consumes psychological control resources, one's performance in the latter activity would decline (20). Besides, after the depletion of psychological control resources, individuals are prone to a sense of uncontrollability to themselves. In other words, they lose their sense of self-efficacy. They would also perceive a sense of uncontrollability to the environment, that is, the sense of other-control. Mindful self-compassion training in combination with aerobic exercise enables adolescents not only to feel the controllability of their own bodies, but also to produce positive mood through emotional transmission. In this way, they can supplement the psychological resources lost in coping with the pressure from the pandemic and reduce their psychological stress.

In addition, it has also been found in this study that although the participants in the control group did not receive intervention, their psychological stress has also declined significantly after a period of time. It can be seen that despite the limited accessibility of self-control resources, individual can recover their self-control resources through a series of ways after they are consumed. This suggests that we should pay attention to family and school, the two most important growth environments for adolescents. From the perspective of parents, feasible activities include parental encouragement, communication, exchange, and even parental physical exercise. When it comes to schools, they can offer some health knowledge lectures, engage students in online classes, and try to provide adolescents with emotional support, so as to improve their sense of self-control and reduce their psychological stress caused by the pandemic.

Analysis of the intervention effect of mindful self-compassion training in combination with aerobic exercise on adolescents' sleep

According to the results of this study, the two groups both have higher scores in all the dimensions of sleep quality before the intervention, which means that the adolescents in both groups have sleep problems to a certain degree. Accordingly, we should not ignore the negative impact of the pandemic on adolescents' sleep. After the intervention, the experiment group has significant improvement in subjective sleep quality, sleep time, sleep efficiency, sleep disorders and hypnotic drugs, at a degree significantly higher than that of the control group. This result shows that the intervention model constructed in this study is effective. Meanwhile, this research result is consistent with those of previous similar studies (21, 22). The incidence of sleep disorders in adolescents is related to both physiological and psychological factors, especially psychological factors. The meta-analysis by Wang and Boros (22) shows that moderate physical exercise has the best promoting effect on sleep quality. The aerobic exercise in this study has certain advantages in the intervention since it is moderate in intensity, easy to learn and simple to implement and poses low requirements on the site. At the same time, mindful self-compassion training is helpful to alleviate the negative effect of psychological factors on adolescents' sleep quality. These two methods promote the functioning of each other and further improve the effect of the intervention.

It is worth noting that the intervention effect of this intervention model on the dimension of daytime dysfunction and sleep latency does not reach a statistically significant level. The reason may be daytime fatigue resulting from adolescents' heavy academic pressure, high demand for sleep and insufficient sleep time. Although self-compassion can deal with emotional problems and enhance psychological resources, the intervention effect is not obvious because adolescents have many learning tasks and suffer large loss of psychological resources.

Conclusion

Attention should be paid to adolescents' mental health during the pandemic, especially their level of psychological stress. In accordance with Self-compassion Theory and other related theories of physical exercise, the intervention model of mindful self-compassion training in combination with aerobic exercise was followed in this study to intervene 53 adolescents with serious emotional problems. The negative mood, psychological stress and sleep of the experiment group and the control group were measured before and after the intervention to make further comparisons. The results show that the intervention model can effectively reduce the negative mood and stress level of the experiment group, and improve their vitality and sleep quality. This inspires us to pay attention to adolescents' psychological stress and combine psychological intervention with exercise intervention to improve the intervention effect.

Journalism Ethics considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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