

INTERVENTION EFFECT OF THE INTEGRATION MODEL ON NEGATIVE EMOTIONS OF ADOLESCENTS DURING THE OUTBREAK OF CORONA VIRUS DISEASE 2019

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SUMMARY

Background: The World Health Organization has declared the Corona Virus Disease 2019 (COVID-19) epidemic as a public health emergency of international concern. Given the sudden infection from and extensive dispersion of COVID-19 and the absence of specific drugs, those infected are in danger if they are not treated in time. Consequently, COVID-19 has become an important factor influencing adolescents' mental health. The purpose of this study is to explore the intervention effect of the integration model on the negative emotions of adolescents during the COVID-19 epidemic.

Subjects and methods: Adolescents were randomly selected from five middle schools in Zhejiang Province of China from May 2020 to July 2020. First, the Self-rating Anxiety Scale, Positive and Negative Affect Scale, and Psychological Well-Being Scale were used for measurement. Then, 72 patients with moderate and severe anxiety symptoms were chosen as the research objects, and the intervention and comparison time was determined to be eight weeks. The subjects were randomly divided into the experiment group (35 members) and the control group (34 members). The integration model was employed on the experiment group.

Results: Grade, physical condition, and sleep time are important factors influencing the anxiety level of adolescents during the COVID-19 period, and the anxiety risk of adolescents is higher during their third year of junior high school. After the intervention, the SAS score of the experiment group is lower than that of the control group, and the decrease in the SAS score is higher in the experiment group than in the control group ($P < 0.01$). Moreover, the positive emotion score of the experiment group is higher than that of the control group, and the negative emotion score of the former is lower than that of the latter. The variances in the positive and negative emotion scores are higher in the experiment group than in the control group ($P < 0.01$). The variance in the overall well-being index is also greater in the experiment group than in the control group ($P < 0.01$).

Conclusion: The intervention using the integrated model can significantly reduce negative emotions such as anxiety, increase positive emotions, and improve the overall well-being of adolescents during the epidemic period.

Key words: Corona Virus Disease 2019 - COVID-19 - integration model – adolescents – intervention - negative emotions

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INTRODUCTION

People are born with a fear of death. This fear becomes more prominent when significant stressful life events occur in the external world, thereby leading to various negative emotions such as anxiety and reducing subjective well-being (Escadas et al. 2019). Li et al. (2020) revealed that sudden public health events are typical significant stressful life occurrences for the public. These events greatly exacerbate people's anxiety about death and therefore exert a negative impact on public mental health. Only one month after its outbreak, the Corona Virus Disease 2019 (COVID-19) was officially declared by the WHO as a sudden public health emergency of international concern in January 2020 given its worldwide influence (Abuhmaidan & Al-Majali 2020, Ilzarbe & Gonzalez 2020). As the COVID-19 is disseminated widely and quickly and no specific drug is available for it thus far, those infected are endangered if they are not treated in a timely manner (Jamali et al. 2020, Jakovljevic et al. 2020). This developments turns the COVID-19 into an important environmental variable

that affects public mental health. Huang and Zhao (2020) conducted a survey on 7236 Chinese Internet users after the outbreak of the epidemic and confirmed that the incidences of general anxiety disorder, depressive symptoms, and sleep disorder were 35.1%, 20.1%, and 18.2%, respectively. The survey results also suggested that the prevalences of anxiety, depression, and sleep disorder were significantly higher in younger than in older groups. Courtney et al. (2020) directly investigated adolescents and verified that the levels of depression and anxiety in children and adolescents increased significantly during the outbreak of the COVID-19. Moreover, related studies have shown that since the outbreak of COVID-19, the incidence of internalized behavior problems in adolescents has increased significantly and their overall well-being index has declined. In particular, the mental health of adolescents who cannot return to school amid the suspension of classes is even more worrying (Duan et al. 2020, Guessoum et al. 2020).

The "Guidelines for Emergent Psychological Crisis Intervention in Infection of COVID-19" issued by the National Health Commission of the People's Republic

of China has provided important guiding principles for the crisis intervention to improve the mental health level of adolescents and minimize the negative emotional impact of the COVID-19 on young people (Ma et al. 2020). Globally, researchers started implementing psychological interventions for adolescent groups with different theories and perspectives. The existing intervention studies in this field mainly focus on the popularization of health knowledge and the intervention of physiological symptoms (Thomas et al. 2020, Chaw et al. 2019), but only a few simple investigations explore psychological intervention (Fan et al. 2020). Nonetheless, the research on mindfulness meditation provides a new perspective for us to alleviate the negative emotional problems of adolescents during the epidemic period. According to Kabat-Zinn (2003), mindfulness means paying attention in a particular way: on purpose, in the present moment, and non-judgmentally. As mindfulness has a good dredging effect on people's psychological problems (Coronado-Montoya et al. 2016), modern psychology has developed mindfulness into a systematic psychotherapy, namely, mindfulness therapy. Mindfulness therapy is actually a type of psychotherapy based on mindfulness. Nowadays, mindfulness therapy has been widely used in medical care, psychological intervention, education, sports, and other fields in developed countries (Mantziose et al. 2019). However, mindfulness research in China have just begun to rise in recent years and currently focuses primarily on the effect of mindfulness intervention on adults or hospital patients (Xu et al. 2018). Duan and Feng (2018) proposed the possibility of applying mindfulness therapy in school mental health education. Subsequently, Dong et al. (2019) established that mindfulness therapy plays a certain role in improving adolescents' anxiety, depression, and adaptation disorder, but no report exists on the realistic application of mindfulness therapy in psychological intervention during the epidemic period.

Studies have confirmed that appropriate physical exercise is an important means to improve physical function, enhance immune capacity, and fight against viruses (Luo et al. 2020). At the same time, relevant intervention research shows that the intervention model dominated by physical exercise can effectively improve people's positive affect, and the positive affect of adolescents are positively correlated with entrepreneurial achievement and optimism (Al-Dmour et al. 2019). Therefore, how to improve the positive affect of adolescents is current research focus (Ren & Li 2020). Although an intervention program based on a single model can help alleviate negative emotions and improve the mental health of adolescents, some researchers pointed out the necessity of integrating different intervention methods and techniques to achieve a maximum intervention effect (Castonguay et al. 2015). Few studies have been conducted on the integration of mindfulness therapy and aerobic physical exercise in psychological intervention. Therefore, the effect of the integration model in

combination with physical exercise and psychological intervention in relieving the negative emotions of adolescents during the epidemic period was verified in the present study, so as to ascertain the intervention effect of the integration model. The results of this work provide direct reference for the intervention in major psychological problems among students during the outbreak of the COVID-19 and also offer empirical evidence for demonstrating the effectiveness of the integration model.

SUBJECTS AND METHODS

Participants

From May 2020 to July 2020, five middle schools were randomly selected in the Zhejiang Province of China. The convenience sampling method was used to investigate adolescents in their junior period (from Grades 1 to 3) in the five schools. All participants volunteered for the survey and consent was obtained. Before the implementation of this investigation, the research team explained the purpose, content, and main intervention methods to the participants. A total of 2120 adolescents submitted their copies of the questionnaire.

Methodology

The Stage One: students from Grades 1 to 3 in the five middle schools from the Zhejiang Province of China were randomly provided with a general information questionnaire and the forms the Self-rating Anxiety Scale, Positive and Negative Affect Scale, and Psychological Well-Being Scale. The second stage: according to the questionnaire survey results in the first stage, 72 students with moderate and severe anxiety symptoms were chosen as the research subjects (Self-rating Anxiety Scale ≥ 61 points). The subjects were randomly divided into the experiment and control groups. No significant difference in gender and age occurs between the two groups. Before the intervention, both groups had 36 members each. After the intervention, two members were lost from the control group and one from the experiment group. The participants who were actually included in the analysis numbered 35 (control group) and 34 (experiment group). All the participants volunteered to take part in the study. After the content, time, place arrangement, rights, and obligations of both parties were discussed, the participants were asked to sign the informed consent at their own will.

On the basis of the previous cross-sectional survey, an integration intervention model was constructed. The model framework includes an aerobics exercise course and mindfulness meditation training. The intervention time is eight weeks. Those with moderate to severe anxiety on the SAS with a total anxiety score ≥ 61 were given the intervention according to the integration model (Xing & Huang 2004). 72 respondents anxiety score ≥ 61 were divided into the experiment and control groups. Changes in the psychological anxiety levels and

negative emotions of the both groups before and after the intervention were compared to verify the effectiveness of the intervention model. The control group was given routine health education support. By contrast, the experiment group was given both routine health education support and the integration model for intervention. The first part of the intervention program involves mindfulness meditation training (Xing & Huang 2004). The main implementation of the mindfulness meditation training was once a day, five days a week (Monday to Friday). The said meditation training was conducted from 21:00-21:30. The venue is a group training online classroom through a Tencent QQ group. The control group did not undergo any mindfulness meditation training intervention. Before the formal implementation of the mindfulness meditation training, the research team provided lectures and exercises on mindfulness meditation for the experiment group. The contents of the lectures include learning the sitting posture and abdominal breathing technique of mindfulness meditation, demonstration and guidance, the role of meditation, as well as problems in the process of practice and the corresponding solutions. The formal intervention period is eight weeks. After the participants arrived at the mindfulness meditation online classroom, they closed their eyes to rest for five minutes and then the recording was played. The participants followed the guidance of the instruction on mindfulness meditation training for 30 minutes. Subsequently, they communicated and explored the experience and their feelings in an exercise through the QQ group. An aerobics exercise course was also implemented for 10 weeks of exercise intervention for the experiment group, whereas the control group did not participate in the aerobic exercise course but only carried out normal activities in daily life and learning. During the intervention period, the 72 students were required to follow their normal school timetable and eating behaviors and were forbidden to take psychotherapy drugs. The second part of the intervention program entails aerobic exercise. Aerobics exercises were performed under the guidance of professional coaches. The frequency of exercises was every Monday, Wednesday, and Friday. The exercise time is 45 minutes for each session. The exercise intensity was at the medium level, that is, the heart rates of participants was within the range of $(220 - \text{age}) \times (60 - 69)\%$ (Sun & Chen 2016). The eight-week aerobics training process was divided into three stages: foundation, improvement, and maintenance. According to the feedback of the exercisers, the intervention program was adjusted in time to ensure the intervention effect of the exercises. During the intervention, 10 participants were randomly selected to wear polar watches (v800 made by Polar Electro OY of Finland) to monitor the exercise intensity and ensure the intervention effect of the exercises. Both the control and the experiment groups received health education on the epidemic situation in their schools. The content of the health education training includes knowledge of epidemic prevention and complications.

Measuring Tools

- *Self-designed questionnaire*: The questionnaire consists of two parts. The first part covers general demographic data, including gender, age, professional background, grade level, and physical condition. The second part involves the living conditions at home during the epidemic period, including 20 items such as sleep time and regularity, diet structure and regularity, exercise intensity, epidemic concern, and leisure style.
- *Self-rating Anxiety Scale (SAS) (Zung 1971)*: The SAS is a professional term in psychology. It is a standard of anxiety assessment used to measure the degree of anxiety and its changes in the process of treatment. The SAS is also mainly employed to evaluate a curative effect. The SAS entails four ratings and chiefly reflects the frequency of symptoms defined by the items. The ratings are as follows: 1 means no or little time, 2 means a small part of the time, 3 means much of the time, and 4 means most or all of the time. After self-rating by participants, the scores from 20 items are added, multiplied by 1.25, and the integral part taken to obtain the standard score. A higher standard score indicates a more severe symptom. Patients with a total anxiety score of under 50 are normal, those with a 50–60 score have mild anxiety, those with a 61–70 score have moderate anxiety, and those with a score above 70 have severe anxiety.
- *Positive and Negative Affect Scale (PANAS) (Watson et al. 1988)*: The PANAS is used to evaluate a positive affect (PA) and negative affect (NA) in individuals. Twenty items are included for this scale, with 10 items each for measuring the PA and NA. A five-point score is utilized. The minimum value of a PA and NA is 10 points, and the maximum value is 50 points. This scale has good reliability and validity and is suitable for the Chinese population (Huang et al. 2003).
- *Psychological Well-Being Scale (PWBS) (Ryff 1989)*: In the PWBS developed by Ryff (1989), psychological well-being is divided into six dimensions: independence, environmental control, self-acceptance, personal growth, life goals, and good relationships. The Chinese version of the PWBS (Pan 2016) was revised for this study. The scale in this work consists of 84 items and is scored with six points. The minimum score is 84 points and the maximum is 504 points. The results show that this version has good validity.

Statistical Analysis

The statistical analysis data were encoded in an Excel spreadsheet, checked and verified by another group of students, and then imported into SPSS 25.0 software for statistical analysis. The measurement data were tested by normality. Data that conformed to normality were expressed by $X \pm s$, and the means were compared by a t-test. In addition, Pearson correlation and stepwise regression analyses were conducted. The inspection level is at $\alpha=0.05$.

RESULTS

General information

In this study, 2120 adolescents from five middle schools submitted their copies of the questionnaire. Excluding 40 unqualified responses, 2080 valid questionnaires were obtained, for an effectivity rate of 98.1%. Participants included 1065 boys (51.2%) and 1015 girls (48.8%). The average age is 14.4±1.0 years old. The anxiety score is 47.5±14.6. A total of 912 (43.8%) of the participants reported anxiety symptoms. Moreover, 55 (26.7%) participants had mild anxiety (50-60 points), 261 (12.5%) had moderate anxiety (61-70 points), and 96 (4.6%) had severe anxiety (≥70 points).

Analysis of factors related to anxiety in adolescents during the COVID-19 period

A Chi square test shows that anxiety in adolescents during the COVID-19 period is associated with grade level, age, self-rated physical condition, and sleep time. The results of the multivariate logistic regression on this basis indicate that grade, physical condition, and sleep time are independent related factors. Compared with students in Grade One, the risk of anxiety in students in Grade Three increases by 45%. For those with higher self-rate physical condition and longer sleep time, the risk of anxiety gradually decreases. The details are shown in Table 1.

Table 1. Analysis of factors related to anxiety in adolescents during the COVID-19 period

Demographic information	n	Number of anxious	Ratio of anxious	χ^2	P	Multiple logistic regression results		
						OR	95%CI of OR	P
Gender								
Male	1065	475	44.6%	0.505	0.477	1		
Female	1015	437	43.1%			0.96	0.8~1.15	0.665
Grade								
One	687	270	39.3%	13.675	0.001	1		
Two	694	299	43.1%			1.12	0.81~1.54	0.505
Three	699	343	49.1%			1.45	1.05~2.35	0.040
Age (years)								
13	450	176	39.1%	15.958	0.001	1		
14	715	301	42.1%			1.07	0.77~1.48	0.687
15	647	291	45.0%			1.02	0.64~1.62	0.945
16	268	144	53.7%			1.33	0.76~2.33	0.312
Self-rate physical condition								
Poor	140	79	56.4%	20.259	<0.001	1		
Relatively poor	356	176	49.4%			0.81	0.54~1.21	0.302
General	518	230	44.4%			0.65	0.45~0.96	0.030
Good	686	280	40.8%			0.58	0.4~0.84	0.004
Very good	380	147	38.7%			0.52	0.35~0.77	0.001
Sleep time								
Less (<6h/d)	155	83	53.5%	13.347	0.001	1		
Medium (6~8h/d)	1246	564	45.3%			0.68	0.48~0.96	0.027
More (≥9h/d)	679	265	39.0%			0.54	0.38~0.77	0.001
Epidemic concern								
1~3 times/d	540	237	43.9%	1.377	0.720	1		
4~6 times/d	1131	493	43.6%			1.04	0.84~1.28	0.728
7~15 times/d	253	118	46.6%			1.13	0.83~1.54	0.433
≥16 times/d	156	64	41.0%			0.95	0.66~1.38	0.806
Exercise time								
<0.5h/d	643	296	46.0%	3.118	0.374	1		
0.5~1h/d	1091	474	43.4%			0.91	0.74~1.11	0.351
1~2h/d	225	96	42.7%			0.88	0.64~1.21	0.444
>2h/d	121	46	38.0%			0.78	0.52~1.17	0.222
Location of home								
Countryside	466	210	45.1%	0.375	0.829	1		
Town	786	343	43.6%			0.95	0.75~1.2	0.685
City	828	359	43.4%			0.96	0.76~1.21	0.699
Whether the only child								
No	348	148	42.5%	0.295	0.587	1		
Yes	1732	764	44.1%			1.10	0.87~1.4	0.424

A total of 72 participants with moderate and severe anxiety symptoms were selected as the research subjects. The participants were randomly divided into experiment and control groups. The two groups are comparable in gender and age. Before the intervention, 36 members belonged to each group. After the intervention, two members were lost from the control group and 1 member was lost from the experiment group. Therefore, the number of participants actually included in the analysis is 35 (control group) and 34 (experiment group).

Comparison of the anxiety scores between the experiment and control groups before and after the intervention

As can be seen from Table 2, no significant difference occurs in the SAS scores between the two groups before the intervention ($t=0.439$, $P=0.662$). After one month of intervention, the SAS scores of the two groups decreased, and the differences in their respective SAS values before the intervention are statistically significant ($P<0.01$). After the intervention, the SAS of the experiment group was lower than that of the control group, and the decrease in the SAS score is higher for the experiment group than for the control group. The differences are statistically significant ($P<0.01$). Clearly, the intervention effect is better on the experiment group than on the control group.

Comparison of the positive and negative emotion scores between the experiment group and the control group before and after the intervention

Table 3 reveals that no significant difference occurs in the positive and negative emotion scores of the two groups before the intervention ($t=0.439$ and 0.321 , $P=0.662$ and 0.750). After one month of intervention, the

positive emotion scores of the two groups both increased, while the negative emotion scores both decreased after the intervention ($P<0.01$). The difference between their respective values before the intervention are statistically significant ($P<0.01$). After the intervention, the positive emotion score is higher in the experiment group than in the control group, and the negative emotion score is lower in the experiment group than in the control group. The variances in the positive and negative emotion scores are higher in the experiment group than in the control group ($P<0.01$), and the differences are statistically significant ($P<0.01$). Thus, the intervention effect is better on the experiment group than on the control group.

Comparison of the overall well-being index between the experiment group and the control group before and after the intervention

Table 4 indicates that no significant difference occurred in the scores for emotional index, life satisfaction, and general well-being index between the two groups ($t=0.372$, 0.320 , and 0.405 ; $P=0.711$, 0.750 , and 0.687). After one month of intervention, the scores for emotional index, life satisfaction, and general well-being index increased in both groups. The differences in the respective values of the experiment group before the intervention are statistically significant ($P<0.01$), while the counterparts for the control group before the intervention are not statistically significant ($P>0.05$). After the intervention, no significant difference occurred in the emotional index and life satisfaction between the two groups ($P>0.05$), but the difference in the overall well-being index is statistically significant ($P=0.040$). However, the variance in the three indicators is greater for the experiment group than for the control group ($P<0.01$). Therefore, the intervention effect is better for the experiment group than for the control group.

Table 2. Comparison of the SAS scores before and after intervention

Group	Before intervention	After intervention	Difference before and after intervention	P value of inter-group comparison
Experiment group (n=35)	66.8±8.1	50.8±9.3	16.0±5.3	<0.001
Control group (n=35)	67.7±8.2	57.1±8.9	10.6±3.3	<0.001
t	0.439	2.873	5.143	
P	0.662	0.005	<0.001	

Table 3. Comparison of the positive and negative emotion scores between the experiment group and the control group before and after intervention

Index	Group	Before intervention	After intervention	Difference before and after intervention	P value of inter-group comparison
Positive affect	Experiment group (n=35)	27.3±7.3	32.7±6.1	5.3±3.4	<0.001
	Control group (n=35)	27.2±8.4	29.2±8.1	2.0±1.9	<0.001
	t	0.057	2.018	5.013	
	P	0.955	0.048	<0.001	
Negative affect	Experiment group (n=35)	24.5±5.9	19.5±4.2	5.0±2.9	<0.001
	Control group (n=35)	24.1±6.7	22.3±6.3	1.7±1.3	<0.001
	t	0.321	2.162	5.978	
	P	0.750	0.034	<0.001	

Table 4. Comparison of the overall well-being index between the experiment group and the control group before and after intervention

Index	Group	Before intervention	After intervention	Difference before and after intervention	P value of inter-group comparison
Emotional index	Experiment group (n=35)	3.6±0.9	4.2±0.9	0.6±0.3	<0.001
	Control group (n=35)	3.7±1.12	3.8±1.0	0.1±0.6	0.386
	t	0.372	1.817	4.430	
	P	0.711	0.074	<0.001	
Life satisfaction	Experiment group (n=35)	3.6±1.4	4.8±1.5	1.1±1.17	<0.001
	Control group (n=35)	3.7±1.4	4.1±1.9	0.4±1.18	0.090
	t	0.320	1.655	2.799	
	P	0.750	0.103	0.007	
Overall well-being index	Experiment group (n=35)	7.6±2.0	9.5±1.9	1.9±1.3	<0.001
	Control group (n=35)	7.8±2.3	8.3±2.7	0.5±1.3	0.051
	t	0.405	2.097	4.382	
	P	0.687	0.040	<0.001	

DISCUSSION

According to the results of this study, grade level, physical condition, and sleep time are the most important factors affecting the anxiety level of adolescents during the COVID-19 epidemic. The risk of anxiety is higher in Grade Three, and better self-rated physical condition and longer sleep time are accompanied by lower anxiety risk. Thus, special attention and more intervention should be given in relation to the mental health status of junior high school students, especially Grade Three students who are under the pressure of pursuing further education. China's education policy requires junior high school students to take a unified entrance examination in each province of China. Only those students who pass the examination can continue to study in senior high school, and the enrollment rate is basically only 50%. Note that the participants in this study are from Zhejiang Province of China. In 2019, it was officially announced that 53.31% students in the said province passed the examination and continued to study in senior high school. Junior high school students in Grade Three face more competition in the examination and have higher negative emotion scores than those in Grades Two and One. Moreover, adolescents' positive evaluation of their physical condition and high-quality sleep are important protective factors to reduce their anxiety risk. This outcome suggests that the intervention in adolescents' mental health and the reduction of their negative emotions can be carried out from two aspects: by improving their self-awareness and promoting their sleep. This finding provides the basis and foundation for us to implement an intervention with the integration model (Ren & Li 2020).

Analysis of the intervention effect of the integration model in reducing adolescents' anxiety

This confirms that no significant difference occurs in the anxiety level between the experiment and the

control groups before the intervention. That is, the baseline levels of the two groups are consistent and comparable pre-intervention. After the intervention, anxiety levels significantly decreased in both groups compared to their respective pre-intervention levels. Therefore, even if only routine epidemic health education support is provided, the anxiety level of adolescents could be reduced to a certain extent. Nevertheless, from the perspective of the reduction degree, the decrease in anxiety is significantly higher in the experiment group than that in the control group, and this result indicates that the intervention effect of the integration model is better. Anxiety generally comes from the uncertainty about the development of events, that is, intolerance of uncertainty is one of the cognitive mechanisms of anxiety (Cui et al. 2019). The uncertainty of disease is also an important reason for individual anxiety (Del Baldo 2019, Kang et al. 2020). Routine epidemic health education support can help adolescents fully understand the disease characteristics, infection and transmission routes, and treatment and prevention of the new coronary virus pneumonia. Such a development is conducive to reducing their uncertainty about the disease, thereby effectively reducing anxiety. This outcome again confirms the necessity and importance for the country to quickly start psychological intervention after the outbreak of a large-scale epidemic (Chen et al. 2020). The intervention effect of the integration model is better for the following reasons. First, adolescents can still enjoy the benefits of routine intervention. Second, physical exercise, namely, an aerobics training course, enables adolescents to find a reasonable, appropriate, and healthy way to vent their anxiety (Ge et al. 2020), improves adolescents' physical self-awareness and sense of self-control to a certain extent, and makes adolescents perceive themselves as capable of resisting external pressure. Third, stress relief intervention based on mindfulness meditation training can better arouse youngster's internal energy and stimulate their self-healing ability (Li et al. 2019).

Analysis of the intervention effect of the integration model in improving adolescents' positive emotions and reducing their negative emotions

Before the intervention, the positive and negative emotions of the two groups are at the same baseline levels, but the integration model has a more significant effect in improving the positive emotions and reducing the negative emotions of adolescents relative to the conventional intervention. Positive emotions are often accompanied by positive and pleasant emotional experience, thereby indicating the satisfaction of an individual's psychological needs. On the contrary, the appearance of negative emotions is often accompanied by negative emotional experience, but an individual's internal psychological world is often in a frustrated state (Nelis et al. 2016). On the one hand, the intervention by the integration model allows adolescents to plan the time and form of proper physical exercise. In this way, adolescents gradually experience a sense of control in exercise, a situation which can meet their needs for competence and independence to a certain extent. Consequently, their basic psychological needs can be met. When their basic psychological needs are met, they would pay more attention to positive events in life, thereby also increasing their positive emotions (Sylvester et al. 2018). Studies have shown that physical exercise can improve individual self-esteem and enhance its function in reducing mood disorders such as depression and anxiety (Dale et al. 2019). On the other hand, the intervention of mindfulness meditation training in the integration model stimulates adolescents' self-healing power, leads them to pay attention to the present, improves their ability to perceive positive emotional experience, and increases their internal psychological resources. These psychological resources enable adolescents to better cope with negative emotional experience and achieve quick recovery (Xu et al. 2018). Physical exercise can also effectively improve adolescents' sleep quality, because individuals must supplement their psychological resources that are excessively consumed in physical exercise through sleep (Kelley et al. 2017).

Analysis of the intervention effect of the integration model in improving adolescents' overall well-being

According to the results of this study, no significant difference occurs in the emotional index, life satisfaction, and the overall well-being index between the experiment group and the control group before the intervention. Nonetheless, these levels all significantly increased in both groups. Compared with the control group, the overall well-being index, emotional index and life satisfaction of the experiment group increased to a greater extent. This research result is consistent with the finding of Kinnunen et al. (2020) on mindfulness

and subjective well-being. In addition to the reasons analyzed above, the significant increase in the overall well-being of adolescents after the intervention is related to the following two factors: first, the intervention with the integration model enables adolescents to perceive more social support. For instance, adolescents can obtain social support from the outside through physical exercise and cooperation with others. Mindfulness meditation training also gives adolescents the opportunity to recall their experience of being accompanied by peers and family members, from which they can also perceive social support (Zhang et al. 2019). Second, the integration model encourages adolescents to pay more attention to the present, enhance the flexibility of their emotional regulation, reduces their attention to negative aspects of the epidemic situation, and helps them adopt positive coping styles so as to improve their life satisfaction (Yang et al. 2020). In addition, the improvement of well-being is closely related to the decrease of anxiety level, the decrease of negative emotions, and the increase of positive emotions. Previous studies have shown that positive emotions can help individuals obtain psychological resilience after stress, and psychological resilience can help individuals better cope with life stress events (Liu et al. 2019). For adolescents, especially those under the pressure of pursuing further education, psychological resilience can assist them to better face academic pressure and other pressures brought about by the epidemic, so that their life satisfaction and overall well-being can be improved.

CONCLUSION

This study involving 2080 adolescents reveals that junior high school students have higher overall anxiety levels during the COVID-19 period and a large proportion of those students have severe anxiety. Grade level, self-awareness of one's physical condition, and sleep are the important risk factors of anxiety in adolescents. Accordingly, an intervention method based on the integrated model was used to conduct an experiment study on those with severe anxiety. The control group was only given routine epidemic health education support. The experiment group implemented the integrated model intervention composed of an aerobics training course and mindfulness meditation training, apart from routine epidemic health education support. After eight weeks of intervention, a significant increase in anxiety levels, an increase in positive emotions, a decrease in negative emotions, and an increase in the overall well-being of the experiment group was observed. These changes suggest that the intervention effect of the integration model is better. The results of this study provide an objective reference for improving the negative emotions of adolescents during the epidemic period. Although this work provides a reference model for educators, the intervention time is slightly shorter. The changes of the effect at different intervention time points (such as after three and after six

months of intervention) can be further investigated in future research. At the same time, the differences in the effects of the three different intervention methods (aerobic exercise, mindfulness therapy and epidemic health knowledge information support) were not distinguished in detail in this study because of limited time and other constraints. Further exploration can be made in future research to better coordinate different intervention methods and maximize the intervention effect.

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Contribution of individual authors:

Conceptualization: Jun Chen & Guoqiang San;
Methodology: Jun Chen, Guoqiang San & Yu Zhang;
Formal analysis: Jun Chen;
Investigation: Jun Chen, Guoqiang San & Yu Zhang;
Data: Jun Chen;
Writing - original draft preparation: Jun Chen;
Writing - review and editing: Jun Chen & Aifeng Jiang.
All authors have read and agreed to the published version of the manuscript.

References

1. Abuhmaidan Y & Al-Majali S: *The Impact of the Corona-virus Pandemic on Mental Health among Al Ain University Students in Light of some Demographic Variables. Psychiatria Danubina* 2020; 32:482-490
2. Al-Dmour RH, Mohammed T & Al-Dmour HH: *Factors Influencing Students' Intentions Towards Entrepreneurship: Comparative Study. International Journal of Sustainable Entrepreneurship and Corporate Social Responsibility* 2019; 4:1-26
3. Castonguay LG, Eubanks CF, Goldfried MR, Muran JC, & Lutz W: *Research on psychotherapy integration: Building on the past, looking to the future. Psychotherapy Research* 2015; 25:365-382
4. Chaw HT, Kamolphiwong S & Wongsritrang K: *Sleep apnea detection using deep learning. Tehnički glasnik* 2019; 13:261-266
5. Chen SH, Dai JM, Hu Q, et al: *Public anxiety and its influencing factors in the initial outbreak of COVID-19. Fudan University Journal of Medical Sciences* 2020; 47:385-391
6. Coronado-Montoya S, Levis AW, Kwakkenbos L, et al: *Reporting of positive results in randomized controlled trials of mindfulness-based mental health interventions. PloS one* 2016; 11: e0153220
7. Courtney D, Watson P, Battaglia M, et al: *COVID-19 impacts on child and youth anxiety and depression: Challenges and opportunities. The Canadian Journal of Psychiatry* 2020; 65:688-691
8. Cui HR, Li W, Pan JY, et al: *Level of intolerance of uncertainty and related factors in patients with anxiety disorders. Journal of Shanghai Jiaotong University (Medical Science)* 2020; 40:75-79
9. Dale LP, Vanderloo L, Moore S & Faulkner G: *Physical activity and depression, anxiety, and self-esteem in children and youth: an umbrella systematic review. Mental Health and Physical Activity* 2019; 16: 66-79
10. Del Baldo M: *Acting as a benefit corporation and a B Corp to responsibly pursue private and public benefits. The case of Paradisi Srl (Italy). International Journal of Corporate Social Responsibility* 2019; 4:1-18
11. Dong YY, Zhan JH, He WM, et al: *Effect of mindfulness therapy on anxiety, depression and adjustment disorder in adolescents. Chinese Journal of Rural Medicine and Pharmacy* 2019; 26:8-9
12. Duan L, Shao X, Wang Y, et al: *An investigation of mental health status of children and adolescents in china during the outbreak of COVID-19. Journal of affective disorders* 2020; 275:112-118
13. Duan WJ & Feng Y: *The application and characteristics of school-based mindfulness intervention. Journal of Psychological Science* 2018; 41:85-90
14. Escadas M, Jalali MS & Farhangmehr M: *Why bad feelings predict good behaviours: The role of positive and negative anticipated emotions on consumer ethical decision making. Business Ethics: A European Review* 2019; 28:529-545
15. Fan YH, Wang JH, Jia XL, et al: *The role of mental problem evaluation and intervention in university or college students kept at home due to serious Corona Virus Disease-2019 epidemic during high education. Pharmaceutical Care and Research* 2020; 20:81-91
16. Ge XY, Huang Q, Xun Y, et al: *Research on the influence of sports app on behavior intention of physical exercise. Journal of Xi'an Physical Education University* 2020; 37:558-567
17. Guessoum SB, Lachal J, Radjack R, et al: *Adolescent psychiatric disorders during the COVID-19 pandemic and lockdown. Psychiatry Research* 2020; 291:113264
18. Huang L, Yang TZ, Ji ZM: *Applicability of the Positive and Negative Affect Scale in Chinese. Chinese Mental Health Journal* 2003; 17:54-56
19. Huang Y, & Zhao N: *Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. Psychiatry Research* 2020; 288:112954
20. Ilzarbe JMB, Gonzalez JCR: *Senergy And Climate Change In The Post-covid-19 Scenario. DYNA* 2020; 95:570-571
21. Jakovljevic M, Bjedov S, Jaksic N & Jakovljevic I: *COVID-19 pandemic and public and global mental health from the perspective of global health security. Psychiatria Danubina* 2020; 32:6-14
22. Jamali D, Barkemeyer R, Leigh J, et al: *Open access, open science, and coronavirus: Mega trends with historical proportions. Business Ethics: A European Review* 2020; 29:419-421
23. Kabat-Zinn J: *Mindfulness-based interventions in context: past, present, and future. clinical psychology: science & practice* 2003; 10:144-156
24. Kang J, Cho YJ & Choi S: *State anxiety, uncertainty in illness, and needs of family members of critically ill patients and their experiences with family-centered multidisciplinary rounds: A mixed model study. PloS one* 2020; 15:e0234296

25. Kelley GA & Kelley KS: Exercise and sleep: a systematic review of previous meta-analyses. *Journal of Evidence-Based Medicine* 2017; 10:26-36
26. Kinnunen SM, Puolakanaho A, Mäkikangas A, Tolvanen A & Lappalainen R: Does a mindfulness-, acceptance-, and value-based intervention for burnout have long-term effects on different levels of subjective well-being? *International Journal of Stress Management* 2020; 27:82-87
27. Li JB, Chen YY & Xiao QG: Exploring the Application of Mindfulness Meditation in the Interventions for the Children with ADHD. *Journal of Psychological Science* 2019; 42:470-476
28. Li M, Zhao T, Huang E, et al: How does a public health emergency motivate People's impulsive consumption? an empirical study during the COVID-19 outbreak in China. *International Journal of Environmental Research and Public Health* 2020; 17:5019
29. Liu DW, Zhou YQ, Li GH: Social Support and Schizophrenia Disability: The Chain Mediating Role of Self Esteem and Resilience. *Chinese Journal of Clinical Psychology* 2019; 27:78-82
30. Luo L, Zeng XJ, Liao X, et al: Disease cognition, coping style and exercise behavior among the public during novel coronavirus epidemic: an online survey. *Chinese Journal of Public Health* 2020; 36:156-159
31. Ma N, Ma H & Li LJ: Psychopharmacology therapy recommendations for patients with the COVID-19. *Chinese Journal of Psychiatry* 2020; 53:95-98
32. Mantzios M, Hussain H, Hussain A, Egan H & Scanlon P: Adult colouring: the effect of app-based vs. pen-and-paper colouring on mindfulness and anxiety. *Health Psychology Report* 2019; 7:286-295
33. Nelis S, Bastin M, Raes F, et al: Trait affectivity and response styles to positive affect: Negative affectivity relates to dampening and positive affectivity relates to enhancing. *Personality & Individual Differences* 2016; 96:148-154
34. Pan JL, Yin HC, Chen AG, et al: An Experimental Study on the Effect of Exercise Intervention on the Executive Functions of Primary Students with and without Learning Difficulties. *China Sport Science* 2016; 36:84-91
35. Ren Y & Li M: Influence of physical exercise on social anxiety of left-behind children in rural areas in china: the mediator and moderator role of perceived social support. *Journal of Affective Disorders* 2020; 266:223-229
36. Ryff CD: Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of personality and social psychology* 1989; 57:1069-1081
37. Sun CY, Chen X: The Effects of Mindfulness Meditation on Improving Middle School Student's Self-control Ability. *China Journal of Health Psychology* 2016; 24:1359-1363
38. Sylvester BD, Curran T, Standage M, Sabiston CM & Beauchamp MR: Predicting exercise motivation and exercise behavior: A moderated mediation model testing the interaction between perceived exercise variety and basic psychological needs satisfaction. *Psychology of sport and exercise* 2018; 36:50-56
39. Watson D, Clark LA & Tellegen A: Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of personality and social psychology* 1988; 54:1063
40. Xing ZJ, Huang LQ: Study of Applying to Citizens in China on Ryff's Psychological Well-being Scales. *China Journal of Health Psychology* 2004; 12:231-233
41. Xu S, Xie JP, Peng L, et al: Effect of psychological intervention of mindfulness on emotional experience and attentional control in soldiers with schizophrenia during rehabilitation. *Journal of third military medical university* 2018; 40:7-12
42. Xu W, Wang YZ, Fu ZF: The Moderating Role of Dispositional Mindfulness and Locus of Control in the Impact of Perceived Stress on Negative Emotions in Daily Life. *Journal of Psychological Science* 2018; 41:239-244
43. Yang H, Che GW, Feng YJ, et al: Psychological Mechanism of Sports Dance to Improve College Students' Psychological Sub-health State:the Mediation Effect of Coping Styles. *Journal of Tianjin University of Sport* 2020; 35:560-565
44. Zhang Y, Fu G, Jiang HL, et al: Relationship of Mindfulness and Post-traumatic Stress Disorder in Professional Rescue Workers: the Roles of Intrusive Rumination and Social Support. *Chinese Journal of Clinical Psychology* 2019; 27:311-315
45. Zung WW: A rating instrument for anxiety disorders. *Psychosomatics* 1971; 12:371-379

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