The Study About the Emotional State and Physical Activity of Adolescents During the COVID-19 Epidemic

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Abstract. To investigate the relationship between emotional status and physical activity in adolescents during the epidemic period of Corona Virus Disease 2019. 600 junior and senior high school students from three municipal middle schools were randomly selected as the research objects. The self-evaluation of anxiety and depression and the evaluation of physical activity were carried out in the form of questionnaire survey. A total of 600 questionnaires were put in and 562 were recovered. The scores of SDS and SAS were 49.30 ± 7.02, and 53.42 ± 5.37 respectively. According to different age groups, there was significant difference in SAS among the three groups in different age groups ($P < 0.05$). The total score of PA was (3.24 ± 0.98). According to different age groups, there were significant differences in PA total score, MVPA activities, physical education activities, weekend activities and one week total activities among the three groups ($P < 0.05$). The total score of anxiety was negatively correlated with the total score of PA ($r = -0.54$, $P = 0.024$), MVPA ($r = -0.38$, $P = 0.049$) and physical education ($r = -0.62$, $P = 0.016$), and the total score of one week was negatively correlated ($r = -0.44$, $P = 0.041$). During the period of Corona Virus Disease 2019 epidemic, the anxiety level of adolescents increases with age, while the physical activity status decreases gradually, and is negatively correlated with anxiety. It is necessary to strengthen sports activities and protect emotional health in this special period.

Keywords: Adolescents · Emotional state · Physical activity

1 Introduction

COVID-19 (Corona Virus Disease 2019) has outbreak since December 2019. By the end of September 30th this year, more than 33.78 million cases have been confirmed and about one million people have died all round the world. The spread of the epidemic, convenient access to information, and unknown feature of the virus have aggravated public panic

W. Fu et al. (Eds.): ICMTEL 2021, LNICST 388, pp. 331–337, 2021.
https://doi.org/10.1007/978-3-030-82565-2_27

and anxiety. Previous studies showed that adolescents who is exposed in major disasters is more sensitive to suffer from psychotic illness than their peers, including anxiety and depression, which may in turn lead to more serious consequences [1]. Therefore, a better understanding and effective intervention of the psychological status of adolescents in this special period can reduce adverse impacts on adolescent's education and social functions. These may avoid depression and anxiety disorders developing into adulthood.

Regular and continuous physical exercise can lead to positive mental health outcomes and provide a buffer against illness [2]. Previous studies showed that even short-term exercise can alleviate the adverse impacts of stressful event on emotion such as trauma, reduce acute and chronic stress, and improve overall mental health. During the COVID-19 epidemic, physical exercises of adolescents decrease due to factors social isolation. Furthermore, because of academic pressure, regular physical classes are often occupied by other cultural courses, which is deemed valuable for future education.

In this study, we investigated the mental status and physical activity of middle school students aged 15–17 during COVID-19 epidemic period, and analyzed the relationship between them. Through clarify the emotional state of teenagers in this special period, and the influence of physical activity on them, it maybe provide the basis for the education department to formulate relevant measures.

2 Methods

2.1 Objects

During the novel corona-virus pneumonia epidemic period, from June 2020 to September, a total of 600 students who aged 15–17 years old coming from Junior high school were evaluated. All samples were assessed for emotion scale, including Self-Rating Anxiety Scale (SAS), Self-rating Depression Scale (SDS) and Physical Activity Questionnaire for Adolescents. In order to eliminate the interference of college entrance examination on the results, students of 18 years old were not included.

2.2 Clinical Assessment

2.2.1 Physical Exercise Assessment

Physical Activity Questionnaire for Adolescents (PAQ-A) was adopted for assessment physical exercise. The original PAQ-A was compiled by University of Saskatchewan, and it was put into use after being edited according to a Chinese norm. Compared with similar exercise scales, it can distinguish sex and age differences sensitively, and reflect the overall physical activity (PA) and moderate to vigorous physical activity (MVPA) of adolescents in the past 7 days truthfully. The questions are clear and easy to understand, and can be completed within 8–10 min, which avoids recall bias. A 5-point system was adopted as the rank variable to facilitate statistics. The good reliability of validity making it as an effective tool for assessing physical activity of adolescents. The total score is the average score of eight questions. The higher the total score is, the higher the level of physical activity [3–6].

2.2.2 Emotion Scale

Self-Rating Anxiety Scale (SAS) and Self-rating Depression Scale (SDS) were adopted for assessment. Formulated by Zung in 1971, SAS is mainly used for assessing subjective feelings of anxiety of the subjects and the changes during the treatment. This scale consists of 20 item scales, with each item had a 4-level score according to the frequency of symptom occurrence, with frequency options explained to students: no or very little time (this situation lasts less than 1 d in the past 1 week), a few time (this situation lasts 1 to 2 d in the past 1 week), considerable time (this situation lasts 3 to 4 d in the past 1 week), and most or all of the time (this situation lasts 5 to 7 d in the past 1 week). After the scoring, the 20 items were converted into standard scores and the anxiety standard score (rounded) = raw score (sum of all item scores) $\times$ 1.25. As shown by the Chinese norm results: $\geq$50 scores represents the existence of anxiety; 50–59 scores represents mild anxiety; 60–69 scores represents moderate anxiety; $\geq$70 scores represent severe anxiety. Self-rating Depression Scale also consists of 20 items with 4-level score. It is originated from the Depression Scale formulated by W.K. Zung in 1965, with form of scale structure and specific assessment method which are similar to that of SAS. 53–62 scores represent mild depression, 63–72 scores represents moderate depression and $\geq$73 scores represents major depression [7, 8].

2.2.3 Statistical Analysis

SPSS21.0 statistical software was used for data processing. Measurement data were expressed as mean value $\pm$ standard deviation ($\bar{X} \pm s$). One-way ANOVA was conducted. Pearson correlation analysis was used to test the correlation between variables. The level of significance was set at $p < 0.05$.

3 Results

3.1 Participant Characteristics

The research data were collected by on-the-spot distribution and self-administered questionnaires. Questionnaires were distributed in three municipal middle schools. The investigators were trained to introduce the significance of this questionnaire survey through the importance of WeChat official account. Those who have questions about the answers to the questions can be instructed and help by investigator at the scene. According to the time taken to fill the questionnaire in pre-survey, the researcher excluded the people who finish it within 10min from the analysis. In this questionnaire survey, totally 600 questionnaires were distributed, and 562 questionnaires were recovered, with a collection rate of 93.67%; 38 questionnaires were not filled out or finished within a too short time, thus, deemed as invalid. Among them, there were 260 males and 302 females, aged 15–17 years old, with an average of 15.1 $\pm$ 1.82 years old.

3.2 Emotion Scale

The scores of Self-rating Depression Scale (SDS) for students were 49.30 $\pm$ 7.02, with 12 students with mild depression (14.05%); The scores of Self-rating Anxiety Scale

(SAS) were 53.42 ± 5.37, with 306 students with anxieties (54.44%), of which, 196 students had mild anxiety (34.88%), 98 students had moderate anxiety (17.44%) and 12 students had severe anxiety (2.14%). According to different age groups, there is no significant difference in SDS of the three groups ($p > 0.05$), and significant differences exist in SAS of the three groups with different ages ($p < 0.05$), which is of statistical significance. Among them, the anxiety score of the group aged 16 (52.80 ± 5.39) is significantly higher than that of the group aged 15 (41.37 ± 6.42), and the anxiety score of the group aged 17 (54.74 ± 5.92) is significantly higher than that the group aged 15, while there is no significant difference between the group aged 16 and the group aged 17. For details, see Table 1.

Table 1. The comparison of anxiety and depression scores in different age groups

Age group (proportion)	SAS	SDA
15 years old (30%)	41.37 ± 6.42	48.32 ± 4.74
16 years old (35%)	52.80 ± 5.39*	49.67 ± 5.42
17 years old (45%)	54.74 ± 5.92*	50.03 ± 8.09
P	0.012	0.534

SAS: Self-rating Anxiety Scale; SDS: Self-rating Depression Scale.
For the one-way analysis of variance, there is no significant difference in SDS of the three groups ($p > 0.05$), and significant differences exist in SAS of the three groups with different ages ($p < 0.05$). *$p < 0.05$ in inter group comparison, compared with 15-year-old group.

3.3 Physical Exercise Status at Different Age Groups

As shown by the PAQ-A scores of students, the total PA score was 3.24 ± 0.98, among the scores of each factor, MVPA activities was 1.41 ± 1.02, physical education activities was 3.26 ± 1.37, the activities during lunch break was 1.72 ± 1.00, after-school activities was 3.62 ± 1.40, evening activities was 2.42 ± 1.06, total evaluation of the week was 3.42 ± 0.80, and daily total evaluation was 3.12 ± 0.46. According to different age groups, the total score of PA, MVPA activities, physical education activities, weekend activities and total activities of the week among three groups had the significant difference ($p < 0.05$), and they were statistically significant; Three groups in different age groups were not statistically significant in the activities during lunch break, after-school activities, evening activities and daily total evaluation ($p > 0.05$); Wherein, the scores of PA score (2.62 ± 0.56), MVPA activities (1.21 ± 0.03), physical education activities (3.21 ± 0.71), weekend activities (2.64 ± 1.02) and total evaluation of the week (3.37 ± 1.03) of the group aged 16 was significantly lower than the group aged 15 (3.64 ± 0.41, 1.59 ± 0.31, 4.34 ± 0.82, 2.72 ± 1.16 and 3.75 ± 1.06). The scores of PA score (2.55 ± 0.71), MVPA activities (1.04 ± 0.21), physical education activities (3.04 ± 0.56), weekend

activities (2.04 ± 1.18) and total evaluation of the week (3.21 ± 1.04) of the group aged 17 was significantly lower than the group aged 15, but there was no significant difference between the group aged 16 and the group aged 17. For details, see Table 2.

Table 2. Scores of Physical Activity Questionnaire for Adolescents (PAQ-A) at different age groups

Age group	Total PA score	MVPA	Physical education activities	Activities during lunch break	After-school activities	Evening activities	Weekend activity	Total evaluation of the week	Total evaluation each day
15	3.64 ± 0.41	1.59 ± 0.31	4.34 ± 0.82	1.77 ± 1.0	3.66 ± 1.21	2.93 ± 1.73	2.72 ± 1.16	3.75 ± 1.06	3.18 ± 0.86
16	2.62 ± 0.56*	1.21 ± 0.03*	3.21 ± 0.71*	1.42 ± 1.2	3.41 ± 1.02	3.01 ± 1.22	2.64 ± 1.02*	3.37 ± 1.03*	3.10 ± 0.84
17	2.55 ± 0.71*	1.04 ± 0.21*	3.04 ± 0.56*	1.31 ± 1.2	2.98 ± 2.1	3.03 ± 0.95	2.04 ± 1.18*	3.21 ± 1.04*	3.12 ± 0.90
P	*0.002*	*0.01*	*< 0.001*	*0.32*	*0.57*	*0.94*	*0.042*	*0.04*	*0.78*

PA: Overall physical activity level, MVPA: Physical activity with the moderate to high intensity; For the one-way analysis of variance, *P < 0.05 in inter group comparison, compared with 15-year-old group.

3.4 Correlation Between SAS and Physical Exercise

Pearson correlation analysis was used to test the correlation between the self-rating anxiety and all PAQ-A factors of physical exercise of adolescents. The result showed that the total anxiety score of adolescents had the significant negative correlation ($r = -0.44$, $P = 0.041$) with the total PA score of PAQ-A ($r = -0.54$ $P = 0.024$), MVPA ($r = -0.38$, $P = 0.049$), physical education activities ($r = -0.62$, $P = 0.016$) and total evaluation of the week.

4 Discussion

The age between 15 and 18 belongs to the late adolescence, which is an important stage of life. In the process of entering adulthood, the adolescent begins to develop a sense of identity and independence, and the personality shaping is becoming more and more perfect, which will bring much pressure for the expectation of academic performance and change of social role. Meanwhile, the environmental pressure and negative social events occurred in the childhood and early adolescence, such as trauma and disaster, jointly form the mental health crisis of this age group. In the recent one year, the COVID-19 epidemic has spread all over the world, and the death toll is increasing. The exaggeration of the media and the panic of the masses all have an impact on the young people, a special susceptible group, which is probably to cause common mental disorders. Therefore, we take middle school students in a city as the research object to explore possible intervention measures for adolescence facing major disasters.

Consistent with the previous research results, our data showed that the anxiety level of the adolescents increased with the ages in the period of COVID-19. Although all depression scores in SDS did not exceed the normal value, but it has shown the trend to break through the upper bound of normal value, which showed the unstable emotions

of the adolescents in this special period. Worldwide, the prevalence of mental disorders (anxiety and depression, etc.) increases significantly in late adolescence. The research showed that 5.6% of the adolescents aged 13–18 suffered from depression and anxiety; persistent depression and anxiety are associated with serious complications such as poor academic performance and social adaptation, adult depression, and suicide [9]. If the adolescents suffered from depression and anxiety in the late stage, the incidence of various behavior problems and somatic symptoms within 10 years after being an adult is 2–3 times than those who had no similar symptoms in the late adolescence, including poor health, migraine, emotional disturbance, poor social adaptation, alcohol addiction and smoking [10]. The suicide risk of the patients who once suffered from the anxiety and depression in the late adolescence is 70 times higher than that of their peers [11]. According to the latest statistics, the suicide rate of Chinese adolescents ranks No. 1 in the world [12]. In China, nearly 0.1 million adolescents commit suicide every year, two people succeed in suicide every minute on average and another 8 people attempt the incomplete suicide [13]. Therefore, paying attention to the psychological status of adolescents in special period, early identification of emotional disorders, and effective intervention can reduce the impact on adolescents' academic and social functions, and cut down the possibility of depression and anxiety disorder continuing to develop into adulthood.

Our research investigated the physical activities of the adolescents aged 15–17, and the results showed that with the age increase, the physical activity was decreasing, and it was negatively correlated to the anxiety emotions. In the late adolescence, the adolescents studied in the middle school or high school, and the schoolwork pressure became more significant with the age increase. It was very common to reduce or occupy PE class schedule, especially in senior high school. Physical education time is used for other courses closely related to higher education, which leads to a significant reduction in actual exercise time. In addition, the COVID-19 epidemic led to the social isolation and closure of public spaces, believed to reduce the possibility of sports. Young people take advantage of the time of online class and contact with computer, which further aggravates the lack of sports. A global survey shows that between the ages of 10 and 19, teenagers' exercise activity decreases by 7% a year [14]. However, one large number of longitudinal and experimental evidence suggested that the regular physical activities can bring positive mental health outcomes and provide a buffer for the disease. The short-term physical exercise can also improve the negative interference effect of the stressful events on the emotion. The physical exercise can significantly reduce the incidence of self-injury in patients with emotional disorders. The clinical meta-analysis showed that the exercise is an effective mean to prevent and treat the depression, anxiety and other unhealthy emotions, and the effect is more significant in the adolescents [15].

Therefore, due to the potential risk of mental disorders in late adolescence, which may become the basis of early adult onset, regular physical exercise can protect emotional health and cognitive function. It is necessary to intervene relevant laws and regulations and other supporting policies to promote the continuous and effective exercise in this group, which has important public health significance.

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