Online Physical Education and the Relationship with Mental Health of College Students during the Outbreak of COVID-19: Online Survey Study in Wuhan

Cheng-Hu Deng, Jing-Qiang Wang, Li-Ming Zhu, He-Wang Liu, Yu Guo, Xue-Hua Peng, Jian-Bo Shao, Wei Xia

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Abstract

Background: Outbreak of COVID-19 has affected the global health. For college students, online physical education was a challenge as an outdoor course.

Objective: The study used data from an online survey to evaluate the relationship of mental health status and exercise status, and the problems of online physical education has been stated as well.

Methods: An online survey was conducted by snowball sampling from May 8th to May 11th. Demographic data, mental health status, exercise status of college students in Wuhan and the issues of online physical education were collected. Mental health status was assessed by the Depression, Anxiety and Stress Scale (DASS-21).

Results: The study included 1607 respondents from 267 cities. The average scores of DASS-21 were significantly lower in our study (for depression, 2.46; for anxiety, 1.48; for stress, 2.59) than previous study ($p<0.05$). Lower scores of DASS-21 were significantly correlated with regular exercise, keeping exercise habits during the outbreak of COVID-19, exercising more than 1 to 2 times a week, exercise duration more than 1 hour, steps on pedometer more than 2000, and sleep duration more than 6 hours ($p<0.05$). None of the 3 forms of the online physical education was supported by more than 50% respondents. Frequent technical problems were confronted by 1087 (67.6%) students. Shape-up exercise (846, 52.6%), designed combination of exercise (710, 44.2%) and Chinese Kungfu (559, 34.8%) were suggested sports for online physical education.

Conclusions: The mental status was significantly correlated with regular exercise, sufficient exercise duration and sleep duration. Professional physical guidance was in urgent need for college students in selected sports. Unsatisfied forms, frequent technical problems, and distant interaction of online physical education were the main problems that should be solved in future.

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Author contributions
CD, and WX conceived and designed the study. YG, XP and JS contributed to the literature search. CD, JW, LZ and HL collected the data. CD and WX analyzed the data. CD drafted the manuscript. WX revised the manuscript. WX had full access to all data in the study and take responsibility for the integrity of data and the accuracy of the data analysis. All authors reviewed and approved the final version of the manuscript.

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Background: Outbreak of COVID-19 has affected the global health. For college students, online physical education was a challenge as an outdoor course.

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2.59) than previous study (*P*<.05). Lower scores of DASS-21 were significantly correlated with regular exercise, keeping exercise habits during the outbreak of COVID-19, exercising more than 1 to 2 times a week, exercise duration more than 1 hour, and steps on pedometer more than 2000(*P*<.05). None of the 3 forms of the online physical education was preferred by more than 50% respondents. Frequent technical problems were confronted by 1087 (67.6%) students. Shape-up exercise (846, 52.6%), designed combination of exercise (710, 44.2%) and Chinese Kungfu (559, 34.8%) were suggested sports for online physical education.

Conclusions: The mental status was significantly correlated with regular exercise and sufficient exercise duration. Professional physical guidance was in need for college students in selected sports. Exercises not meeting students' preferences, frequent technical problems, and distant interaction of online physical education were the main problems that should be solved in future.

Key words: COVID-19; college students; mental status; physical education

Introduction

Since December 2019, a novel coronal virus (Sars-Cov-2) has been first recognized in Wuhan and then quickly spread out to the whole world, with millions of people infected [1]. Furthermore, uninfected people were also suffered a lot and had to adopt a totally different lifestyle because of quarantine in Wuhan [2]. All the basic necessities of living had been transferred to on-line style, as well as education [3, 4]. Online education was not a new thing in many fields [5], except for sports which need essential interaction between teachers and students.

As we known, previous studies have stated that mental illness symptoms were not uncommon among university students according to the Depression, Anxiety and Stress Scale (DASS-21) [6, 7]. And Dogra's study have described that vigorous physical activity was associated with lower possibilities of poor mental health, as well as lower possibilities of higher depressive symptoms [8]. As physical education has an important role in relieving pressure not only on body but also on mind [9], it is particularly essential under this circumstance [10]. According to report of the united nations educational scientific and cultural organization (UNESCO), more than 160 countries have shut down their schools [11], online physical education has been the issue that most countries have to face. As reported, Sars-Cov-2 would coexist with human for a long time [12], which suggested that online physical education could last for a relatively long time in the future. A recent scientometric analysis reviewed the research topics related to COVID-19 and the impact of COVID-19 on physical education was not researched [13].

Since February, online physical education, which was the only choice in a quarantined city, has been adopted by many universities and colleges in Wuhan [14]. Whether the online physical education was efficient or just a waste of time could be reflected by the mental and physical state of students. Several studies have reported the mental state of general population, medical staff or college students separately during the peak of this coronavirus disease (COVID-19) epidemic, which have proved the existence of anxiety, depression and stress in different population [15-18]. However, so far as we know, no report has been found on evaluating the mental and physical state of students in Wuhan universities and colleges after the implement of online physical education.

As a newly developed way of physical education, there were challenge and chances for it. Because of the characteristics of physical education, suitable sports should be chosen considering the restriction of sport field and related equipment. Also, how the network platforms and teaching resources for online physical education performed was still a question. Furthermore, whether there was extended effect of online physical education on family member when it's carried out at home was in concern, which might be related to the atmosphere similar to class learning.

Therefore, the primary aim of our study is to describe the association between mental health and

physical activity of students in Wuhan universities and colleges after the 3-month online physical education. And the secondary aim of our study is to figure out the problems that students confronted during the online study, and we hope that it could be solved by educators in the near future.

Methods

Study design and study population

This cross-section study was carried out from May 8th to May 11th. A snowball strategy was employed for recruiting students in Wuhan universities and colleges after 3-month online physical education.

Procedure

As to minimize the face-to-face interaction recommended by Chinese Government, an anonymous questionnaire was completed through an online survey platform (SurveyStar, Changsha Ranxing Science and Technology, Shanghai, China). The online survey was disseminated by teachers to students first through the educational platform, and the students were encouraged to spread it to other students. This study was approved by institutional review board of Wuhan children's hospital (WHCH 2020029). The informed consent was included at the very beginning of this online survey, and informed consents were provided by all the respondents.

Measurements and outcomes

A structured questionnaire was employed to evaluate the mental health status and sports-related lifestyle of students in Wuhan universities and colleges, as well as the issues of the online physical education. The structured questionnaire was composed of questions on (1) demographic data; (2) mental health status; (3) sports-related lifestyle; (4) issues of online physical education. There were 45 items included in the questionnaire and it approximately took 6 minutes to complete it.

Demographic data included gender, age, grade, residential location, and body-mass index (BMI) which was calculated as weight divided by the square of height. The categorization of BMI was based on a reference data for Chinese (BMI□18.5, 18.5≤BMI□23, 23≤BMI□26, 26≤BMI) [19]. Mental health status of students was evaluated by Depression, Anxiety and Stress Scale (DASS-21), which consisted of depression, anxiety and stress subscales [20]. Sports-related lifestyle variables included the exercise habits, change of weight, frequency and duration of exercise, preferred sports, steps on pedometer, and access to sports facility. The minimal amount of weight to indicate weight loss or weight increase is 3 kilogram. The average steps on pedometer were calculated as the average steps taken per day during the past month by a mobile phone application WeChat (Tencent, Shenzhen, China). There was no control for other physical activities or exercises performed beyond "online physical education". Variables for issues of online physical education included different exercise classes offered, frequency of online physical education, influence on other family members which might be related to atmosphere similar to class learning, troubles confronted, and suggested sport for online physical education.

Except for the total score of DASS-21 scale, the scores of three subscales were calculated as follows [15]: depression subscale was consisted of questions 3, 5, 10, 13, 16, 17 and 21, classified into normal (0–9), mild depression (10–12), moderate depression (13–20), severe depression (21–27), and extremely severe depression (28–42); anxiety subscale was consisted of questions 2, 4, 7, 9, 15, 19, and 20, classified into normal (0–6), mild anxiety (7–9), moderate anxiety (10–14), severe

anxiety (15–19), and extremely severe anxiety (20–42); stress subscale was consisted of questions 1, 6, 8, 11, 12, 14, and 18, classified into normal (0–10), mild stress (11–18), moderate stress (19–26), severe stress (27–34), and extremely severe stress (35–42).

Statistical analysis

The subjects who didn't complete the questionnaire were not included in our study, we deleted the respondents with missing data. The descriptive statistics were employed for categorical variables, including variables of demographic data, sports-related lifestyle, and issues of online physical education. Each categorical variable was presented as percentages of response to corresponding question, which was calculated by the number of respondents per response to the number of total responses of the question. The scores of DASS-21 and its subscales were expressed as mean and standard deviation, as well as median and inter-quartile range. The values of Cronbach's alpha on reliability of DASS-21 and its subscales were calculated, as a measure of internal consistency. A descriptive comparison of the mean score of subscales of DASS-21 between our and Wang's first study, which had described the mental health state of general population during the peak of COVID-19 epidemic [15], had been carried out. Linear regressions were used to analyze the univariate association between sports-related lifestyle and the DASS-21 scales. All the tests were two-tailed, with a significance level of P <·05. Statistical analysis was performed on SPSS Statistic 19.0 (IBM SPSS Statistics, New York, United States).

Results

Survey Respondents

A total of 1673 respondents have been received, as 66 respondents did not complete the questionnaires, we included 1607 (96.1%) respondents from 267 cities. The questionnaires were received on the first day (May 8th) in 292 respondents, on the second day (May 9th) in 1130 respondents, on the third day (May 10th) in 130 respondents and on the fourth day (May 11th) in 55 respondents.

Demographic data

The demographic features of all the students in our study were shown in Table 1. Most respondents were male students (1041, 64.8%), with an age range from 18 to 22 years old in predominant (1573, 97.9%). Most of the students were freshman or sophomore (1524, 94.8%), and urban (723, 45%) was the most common place of residence in college students. The BMI values in most college students were in normal range (969, 60.3%), while the BMI values of 638 (39.7%) respondents were out of the normal range.

Table 1. The demographic feature of respondents

Demographic variables	Cases (percentage)
Gender	
Male	1041 (64.8%)
Female	566 (35.2%)
Age (years)	
Younger than 18 years	20 (1.2%)

18 to 22 years old	1573 (97.9%)
Older than 22 years	14 (0.9%)
Grade	
Freshman	784 (48.8%)
Sophomore	740 (46.0%)
Junior	70 (4.4%)
Senior	13 (0.8%)
Place of residence	
Urban	723 (45.0%)
Rural-urban	431 (26.8%)
Rural	453 (28.2%)
Body-mass index (BMI)	
BMI□18.5	275 (17.1%)
18.5≤BMI□23	969 (60.3%)
23≤BMI□26	231 (14.4%)
26≤BMI	132 (8.2%)

Mental health status

The mental health status was measured by DASS-21 scale. The mean value (standard deviation, SD) of total score on DASS-21 was 6.52 (7.86). The mean values of depression, anxiety and stress subscales were 2.46 (3.02), 1.48 (2.35), and 2.59 (3.09), separately. The median (inter-quartile range, IQR) of total score on DASS-21 was 4 (1 to 10). The median of depression, anxiety and stress subscales were 1 (0 to 4), 0 (0 to 2), 1 (0 to 4), separately. The comparison between our study and Wang's study [15] was as follows: For depression subscale, 2.46 (3.02) versus 6.25 (7.16); for anxiety subscale, 1.48 (2.35) versus 6.16 (6.57); for stress subscale, 2.59 (3.09) versus 7.76 (7.74). The cases (percentages) of different groups in depression, anxiety and stress subscale were shown in Table 2. The value of Cronbach's alpha on reliability of DASS-21 was 0.94, and values of Cronbach's alpha for depression, anxiety and stress subscales were 0.84, 0.85, 0.86, separately.

Table 2. Constitution of respondents in depression, anxiety and stress subscales of DASS-21

SS-21	Normal n (%)	Mild n (%)	Moderate n (%)	Severe n (%)	Extremely severe n (%)
pression	1551 (96.5%)	36 (2.2%)	19 (1.2%)	1 (0.1%)	0 (0.0%)
xiety	1519 (94.5%)	71 (4.4%)	14 (0.9%)	2 (0.1%)	1 (0.1%)
ess	1574 (97.9%)	30 (1.9%)	3 (0.2%)	0 (0.0%)	0 (0.0%)

Sports-related lifestyleExercise status

The sports-related lifestyle in college students was shown in Table 3. Although most of the students (1088, 67.7%) exercised regularly, 1279 (79.6%) of the students have been disturbed by the outbreak of COVID-19 with less time spent on sports (826, 51.4%) and weight gain (592, 36.8%). Exercising less than 3 times a week was observed in 1010 (62.9%), and average steps on pedometer less than 2000 was observed in 1155 (71.9%). Restriction on sports facility have been confronted by 1198 (74.5%) students.

Table 3. The sports-related lifestyle after the outbreak of COVID-19

Sports-related lifestyle	Cases (percentage)
Do you exercise regularly[a]	

Yes	1088 (67.7%)
No	519 (32.3%)
Negative influence of COVID-19 on exercise habits	
No, exercise habits was maintained	328 (20.4%)
Yes, but little.	889 (55.3%)
Yes, it has a great impact on my exercise habits	390 (24.3%)
Time spent on sports after the outbreak of COVID-19[b]	
Less	826 (51.4%)
Same	460 (28.6%)
More	321 (20.0%)
Weight change after the outbreak of COVID-19[c]	
Less	321 (20.0%)
Same	694 (43.2%)
More	592 (36.8%)
Frequency of exercise	
Occasionally or never	549 (34.2%)
1 to 2 times a week	461 (28.7%)
No less than 3 times a week	377 (23.4%)
Everyday	220 (13.7%)
Average duration of exercise performed in a week	
Less than 1 hour	1253 (78.0%)
More than 1 hour	354 (22.0%)
Favorite sport after the outbreak of COVID-19	
High-intensity Interval Training	119 (7.4%)
Shape-up exercise	200 (12.4%)
Strength training	312 (19.4%)
Ball game	288 (17.9%)
Walking	665 (41.4%)
Body combat	23 (1.4%)
Average steps on pedometer[d]	
0-500	413 (25.7%)
501-2000	742 (46.2%)
2001-4000	224 (13.9%)
More than 4000	228 (14.2%)
Restriction on sports facilities	
Yes	1198 (74.5%)
No	409 (25.5%)

[a] Exercising regularly was restricted as no less than 3 times a week and no less than 60 minutes each time.

[b] Time spent on sports referred to time spent on all kinds of sports, including online physical education.

[c] The minimal amount of weight to indicate weight loss or weight increase is 3 kilogram.

[d] The average steps on pedometer were calculated as the average steps taken per day during the past month by a mobile phone application WeChat.

The differences in the association between sports-related lifestyle variables and scores of DASS-21 and its subscales are represented in Table 4. The respondents who exercised regularly had a lower scores of DASS-21 and its all subscales (for depression, B=-1.257, t=-7.962, *P*<.001; for anxiety, B=-0.700, T=-5.636, *P*<.001; for stress, B=-1.013, t=-6.211, *P*<.001; for total score, B=-2.969, t=-7.197, *P*<.001), as well as the respondents whose exercise habits were kept during the outbreak (for depression, B=-2.017, t=-9.171, *P*<.001; for anxiety, B=-1.211,t=-6.988, *P*<.001; for stress, B=-2.198,t=-9.788, *P*<.001; for total score, B=-5.427, t=-9.491, *P*<.001) or influenced little by the outbreak (for depression, B=-1.301, t=-7.299, *P*<.001; for anxiety, B=-0.783; t=-5.572, *P*<.001; for

stress, B=-1.446,t=-7.941, *P*<.001; for total score, B=-3.530, t=-7.616; *P*<.001). The respondents who exercised more than 1 to 2 times a week demonstrated significantly lower scores of DASS-21 and all its subscales as compared to respondents who exercised occasionally, with all *P*<0.05. The respondents who exercised more than 1 hour had a lower score on total score (B=-1.350, t=-2.861, *P*=0.004) and depression (B=-0.588, t=-3.248, *P*=0.001), stress (B=-0.503, t=-2.708, *P*=0.007) subscales of DASS-21, compared to respondents who exercised less than 1 hour. Respondents with average steps on pedometer more than 2000 had significantly lower scores of DASS-21 and all its subscales compared to respondents with average steps less than 500, with all *P*<0.05.

Table 4. Association between sports-related lifestyle variables and scores of DASS-21 and its subscales

rts-related tyle ables	Depression			Anxiety			Stress			Total		
	B	t	P	B	t	P	B	t	P	B	t	P
rcise regularly[a]												
	-.195	-7.962	<.001	-.139	-5.636	<.001	-.153	-6.211	<.001	-.177	-7.197	<.001
	Reference											
ative influence of COVID-19 on exercise habits												
exercise ts was tained	-.270	-9.171	<.001	-.208	-6.988	<.001	-.287	-9.788	<.001	-.279	-9.491	<.001
but little. it has a t impact on exercise ts	-.215	-7.299	<.001	-.166	-5.572	<.001	-.233	-7.941	<.001	-.223	-7.616	<.001
	Reference											
e spent on sports after the outbreak of COVID-19[b]												
e	-.075	-2.854	.004	-.037	-1.398	.16	-.046	-1.750	.08	-.058	-2.202	.03
e	-.102	-3.896	<.001	-.043	-1.645	.10	-.100	-3.807	<.001	-.091	-3.485	.001
	Reference											
ght change after the outbreak of COVID-19[c]												
	.018	0.633	.53	.012	0.442	.66	-.009	-0.322	.75	.007	0.249	.80
e	-.035	-1.275	.20	-.036	-1.300	.20	-.081	-2.938	.003	-.056	-2.034	.04
e	Reference											
uency of exercise												
yday	-.109	-3.998	<.001	-.095	-3.477	.001	-.086	-3.155	.002	-.104	-3.820	<.001
ess than 3 s a week	-.146	-5.212	<.001	-.096	-3.387	.001	-.122	-4.337	<.001	-.133	-4.724	<.001
2 times a k	-.112	-3.946	<.001	-.089	-3.124	.002	-.084	-2.949	.003	-.102	-3.613	<.001
asionally ever	Reference											
rage duration of exercise performed in a week												
e than 1	-.081	-3.248	.001	-.046	-1.833	.07	-.067	-2.708	.007	-.071	-2.861	.004
than 1	Reference											
rage steps on pedometer[d]												
e than 0	-.123	-4.283	<.001	-.100	-3.487	.001	-.115	-4.026	<.001	-.122	-4.275	<.001
-4000	-.103	-3.620	<.001	-.062	-2.175	.03	-.085	-2.971	.003	-.092	-3.212	.001
2000 0	-.078	-2.566	.01	-.044	-1.443	.15	-.063	-2.078	.04	-.068	-2.236	.03
	Reference											
riction on sports facility												
	-.040	-1.602	.11	-.027	-1.065	.29	-.084	-3.368	.001	-.056	-2.258	.02
	Reference											

[a] Exercising regularly was restricted as no less than 3 times a week and no less than 60 minutes each time.
[b] Time spent on sports referred to time spent on all kinds of sports, including online physical education.
[c] The minimal amount of weight to indicate weight loss or weight increase is 3 kilogram.
[d] The average steps on pedometer were calculated as the average steps taken per day during the past month by a mobile phone application WeChat.

Issues of online physical education

There were 3 main patterns that had been adopted by universities and colleges in Wuhan, interaction between teachers and students were the most common way (1056, 65.7%). And it was the only way that students could interact with teacher, while the other two ways were unilateral teaching. Online physical education was accessed once a week or less in 1256 (78.2%) students. Surprisingly, the family members of 728 (45.3%) students could be motivated to exercise because of online physical education. There are many problems during the online physical education which have been confronted by 1087 (67.6%) students. Considering the convenience and availability, shape-up exercise, designed combination of exercise by teacher for specific purpose and Chinese Kungfu were suggested sports for online physical education. Here, designed combination of exercise was a combination of various exercises for physical education, which was designed by teachers, for example, a combination of shape-up exercise and Chinese Kungfu. The detailed information was summarized in Table 5.

Table 5. The condition and problems of online physical education

The condition and problems of online physical education	Cases (percentage)
The pattern of online physical education you have participated	
Watching recorded video	841 (52.3%)
Watching real time video	820 (51.0%)
Communicating with teacher on education platform	1056 (65.7%)
The pattern of online physical education you preferred	
Watching recorded video	497 (30.9%)
Watching real time video	536 (33.4%)
Communicating with teacher on education platform	574 (35.7%)
The frequency of online physical education	
Once every two weeks	25 (1.6%)
Once a week	1231 (76.6%)
Twice a week	351 (21.8%)
Has online physical education motivated other family member exercising	
Yes	728 (45.3%)
No	879 (54.7%)
The problems you have confronted during online physical education	
Network instability	752 (46.8%)
Unfamiliar with software	384 (23.9%)
No interaction with teacher	481 (29.9%)
Lack of self-control	608 (37.8%)
Can’t keep up with the lesson	73 (4.5%)
Frequency of technical problems (network, software, platform) you have confronted	
Every class	142 (8.8%)
More than 4 times a month	270 (16.8%)
No more than 4 times a month	675 (42.0%)
Never	520 (32.4%)
Would you still like to have physical education online	

Yes	760 (47.3%)
No	847 (52.7%)
The proper sports you suggest for online physical education	
Shape-up exercise	846 (52.6%)
Designed combination of exercise	710 (44.2%)
Chinese Kungfu	559 (34.8%)
Rhythmic sport	459 (28.6%)
Table tennis	364 (22.7%)

Discussion

Principal findings

The main purpose of our study was to figure out the mental status of college students by DASS-21 after 3-month online physical education, and evaluate the relationship of mental health status and sports-related lifestyle. An online survey was employed to collect related information. Results showed that average scores of DASS-21 subscales were significantly lower than previous study. Lower scores of DASS-21 were significantly correlated with positive sports-related lifestyle. Furthermore, online physical education was not satisfied with several issues on technology and content.

Relationship between mental health status and sports-related lifestyle Previous studies have proven the facts that general population, including college students, suffered from a storm induced by the outbreak of COVID-19 [21, 22]. According to DASS-21, depression, anxiety and stress could be observed in population during the outbreak of COVID-19 in China, which lasted for at least 4 weeks [15], including general population [23], general work force [24], psychiatric patients [25] and healthcare professionals [26]. Changed life style has to be rebuilt and adopted by all groups of population. As for college students, except for ordinary life style, a brand new education style has been built in a hurry. Physical education, as a typical outdoor course, had to be carried out by online style. Whether the physical education is essential during this epidemic of COVID-19 and how to carry it out properly is the issue that most countries have to face for a not short period.
In Wang's study, which reported a higher psychological impact of COVID-19 in respondents aged 12-21·4 years, it suggested that respondents in this age group may be affected by prolonged school closure and requiring online education support [15]. Comparing our study with Wang's study, lower scores of DASS-21 subscales could be observed in our study, which was obtained 3-month after online physical education. The difference between our study and previous study may be result from the restoring online education support, in which physical education was an important part. In order to demonstrate the importance of exercise in our study, linear regression was employed to analyze the correlation between the scores of DASS-21 and sports-related lifestyle variables. Not surprisingly, lower scores of DASS-21 and its subscales were observed in respondents who exercised regularly and have kept the exercise habits during the outbreak of COVID-19. The respondents who exercised more than 1 to 2 times a week, had an exercise duration more than 1 hour, and had average steps on pedometer more than 2000 had significantly lower score of DASS-21 and all its subscales compared to the references respectively. The data suggested that exercise, especially regular exercise with sufficient duration, was related to the lower risk of the mental disturbance, which was in accordance with previous study [27]. It may be confusing that more than 70% respondents accumulating less than 2000 steps per day, but the mean DASS-21 values were low. We thought that the low steps per day may related to the exercises that physical class chosen under this COVID-19 confinements. As some exercise may not take many steps, such as Tai chi and shape-up exercise. According to a large cross-section study, which has verified that all exercise types were significantly associated with lower mental health burden [28], exercise itself mattered rather than the types. A strong evidence from a meta-analysis supported that exercise can protect population from emergency of depression regardless of age and geographical region [29], which could be applied to this COVID-19 pandemic.

Therefore, we suggested that positive sports-related lifestyle was significantly associated with mental health under the circumference of this COVID-19 pandemic.

The issues should be paid attention to on online physical education

However, it was a pity that 1198 (74.5%) respondents confronted the restriction on sports facilities, which might obstacle them keeping exercise regularly. Moreover, the BMI of 638 (39.7%) respondents was out of the normal range, which might be related to the unhealthy life style [30]. It suggested that the professional guidance of physical education was in need for the respondents, considering the available facilities and equipments. It was interesting that other family members motivated exercising by online physical education was observed in 728 (45.3%) respondents. The participation of other family members could be considered as classmates' companion, which might be related to atmosphere similar to class learning. It also suggested that online physical education was not only a newly learning style for college students, but also probably a newly life style for general population [31, 32].

As stated above, effective online physical education was an essential part for the rebuilding of life style, not only for college students, but also for general population as part of the behavior therapy [33], health education [34] and promotion by local health authority [35]. However, as a totally new way for physical education, there were several issues of online learning that have to be indicated. So far as we known, only three ways of online physical education were available for college students, including watching recorded video, watching real time video and communicating with teacher on education platform. But none of them was preferred by more than 50% respondents, and more than 50% respondents didn't want to have physical education online. But in contrary, family members motivated exercising by online physical education could be observed in nearly 50% respondents. It might suggest that online physical education was welcome by general population, but it can't meet the requirements of college students. We thought that the dissatisfaction of college students may result from the comparison between online physical class and face-to-face class, while general population would be interested in trying this new style without the knowledge of face-to-face class. Moreover, frequent technical problems have been confronted by 1087 (67.6%) respondents, including network instability (752, 46.8%), unfamiliar with software (384, 23.9%), which further worsened the experience of the physical course. Furthermore, no interaction with teacher (481, 29.9%), lack of self-control (608, 37.8%) and can't keep up with the lesson (73, 4.5%) could be observed in respondents, which would frustrate the college students. But Soffer's study suggested that in many aspects of the examined effectiveness, online education was at least as effective as face to face course [36]. We supposed that online physical education is promising, if substantial improvement was made on technology support, optional exercises and students' preferences. According to Chekroud's study, all exercise types were significantly associated with lower mental health burden, plenty of exercise could be chosen for online physical education [28]. Considering the accessing to sports facility and available sports equipment, only several sports were suggested for online physical education, including shape-up exercise, designed combination of exercise, Chinese Kungfu, rhythmic sport and table tennis, while ordinary physical courses could not be carried out properly, such as ball games and athletics events. How to improve physical fitness of the college students with limited sports is the major issue of online physical education, which we might learn from other courses and search help from other filed, such as virtual reality [37].

Limitations

There are several limitations in our study. First, as the anonymity and confidentiality requirements, prospective study was unavailable through the online snowball sampling survey, and the respondents to the survey may not represent the sample for Chinese students. Second, the mental health was evaluated by DASS-21 scale instead of by mental health professionals, the floor effects could not be excluded, though both of them were based on the respondents feeling and self-reporting. Third, as

the inherent nature of a cross-section study, we could only verify the association between sports-related lifestyle and mental health, but not the causal relationship. Finally, the assessment of sports-related lifestyle variables depends on non-standardized questions that have not been validated.

Conclusions

The mental status was normal in most of the college students in Wuhan. The mental status was significantly correlated with regular exercise and sufficient exercise duration. Therefore, professional physical guidance was in need for college students, as well as general population. Considering the restriction on sports facility and equipment, selected sports were suggested for online physical education to improve physical fitness. However, online physical education was still far away from satisfied. Exercises not meeting students' preferences, frequent technical problems, and distant interaction were the main problems that should be solved in future.

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Author contributions

CD, and WX conceived and designed the study. YG, XP and JS contributed to the literature search. CD, JW, LZ and HL collected the data. CD and WX analyzed the data. CD drafted the manuscript. WX revised the manuscript. WX had full access to all data in the study and take responsibility for the integrity of data and the accuracy of the data analysis. All authors reviewed and approved the final version of the manuscript.

Conflicts of Interest

None declared.

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