

# EFFECTS OF PHYSICAL EXERCISE ON MOOD AND SLEEP QUALITY OF COLLEGE STUDENTS UNDER THE COVID-19 EPIDEMIC

IMPACTO DO EXERCÍCIO FÍSICO NO HUMOR E NA QUALIDADE DO SONO DE ESTUDANTES UNIVERSITÁRIOS NO CONTEXTO DO COVID-19

IMPACTO DEL EJERCICIO FÍSICO EN EL ESTADO DE ÁNIMO Y LA CALIDAD DEL SUEÑO DE ESTUDIANTES UNIVERSITARIOS EN EL CONTEXTO DEL COVID-19

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## ABSTRACT

**Introduction:** The management of university campuses in the context of COVID-19 makes the mental health of college students draw much attention. **Objective:** To explore the effects of physical exercise under COVID-19 on sleep quality and mood of college students. **Methods:** 1983 college students from The Civil Aviation University of China were selected, and their physical exercise state, sleep quality, and emotional state were measured by a questionnaire. **Results:** Physical exercise has a significant positive effect on college students' mood and sleep quality, and sleep quality has a considerable impact on their mood. There is no gender difference in mood and sleep quality. The amount of physical exercise has a significant difference in sleep quality and mood. Compared with the students who do a lot of physical exercises, those who do a lot of physical exercises have higher sleep quality and more vital stronger emotional control ability. **Conclusion:** This study can provide a reference for universities to carry out mental health education during the particular period of epidemic prevention and control. **Level of evidence II; Diagnostic Studies—Investigating a Diagnostic Test.**

**Keywords:** COVID-19; Physical Exercise; Emotions; Sleep.

## RESUMO

**Introdução:** A gestão do campus universitário no contexto do COVID-19 faz com que a saúde mental dos universitários chame muita atenção. **Objetivo:** Explorar os efeitos do exercício físico sob o COVID-19 sobre a qualidade do sono e o humor dos estudantes universitários. **Métodos:** Foram selecionados 1983 estudantes universitários da Universidade de Aviação Civil da China, e seu estado de exercício físico, qualidade do sono e estado emocional foram medidos por um questionário. **Resultados:** O exercício físico tem um efeito positivo significativo no humor e na qualidade do sono dos estudantes universitários, e a qualidade do sono tem um efeito significativo em seu humor. Não há diferença de gênero no humor e na qualidade do sono. A quantidade de exercício físico tem diferença significativa na qualidade do sono e no humor. Em comparação com os alunos que fazem muito exercício físico, os alunos que fazem muito exercício físico têm maior qualidade de sono e maior capacidade de controle emocional. **Conclusão:** Este estudo pode fornecer referência para que as universidades realizem a educação em saúde mental durante o período especial de prevenção e controle de epidemias. **Nível de evidência II; Estudos de Diagnóstico — Investigando um Teste de Diagnóstico.**

**Descritores:** COVID-19; Exercício Físico; Emoções; Sono.

## RESUMEN

**Introducción:** la gestión del campus universitario en el contexto del COVID-19 hace que la salud mental de los estudiantes universitarios llame mucho la atención. **Objetivo:** explorar los efectos del ejercicio físico bajo COVID-19 sobre la calidad del sueño y el estado de ánimo de estudiantes universitarios. **Métodos:** se selecciona estudiantes universitarios 1983 de la universidad de aviación Civil de China, y se midió su estado de ejercicio físico, calidad del sueño y estado emocional mediante un cuestionario. **Resultados:** el ejercicio físico tiene un efecto positivo significativo en el estado de ánimo y la calidad del sueño de los estudiantes universitarios, y la calidad del sueño tiene un efecto significativo en su estado de ánimo. No hay diferencia de género en cuanto al estado de ánimo y la calidad del sueño. La cantidad de ejercicio físico tiene una diferencia significativa en la calidad del sueño y el estado de ánimo. En comparación con los estudiantes que hacen mucho ejercicio físico, los estudiantes que hacen mucho ejercicio físico tienen una mayor calidad de sueño y una mayor capacidad de control emocional. **Conclusión:** este estudio puede servir de referencia para que las universidades realicen educación en salud mental durante el período especial de prevención y control de epidemias. **Nivel de Evidencia II; Estudios diagnósticos: investigación de una prueba diagnóstica.**

**Descriptor:** COVID-19; Ejercicio Físico; Emociones; Sueño.



## INTRODUCTION

COVID-19, which broke out at the end of 2019, posed a severe threat to human health and life safety, and had a significant impact on the public's physical and mental health.<sup>1</sup> The Chinese government has taken different isolation and blockade measures according to the situation of the epidemic, which has quickly contained the development of the epidemic. Under the influence of public emergencies such as an epidemic, college students will have a higher stress response and are prone to psychological and behavioral problems, such as sleep problems and anxiety.<sup>2</sup> In May 2020, China's epidemic prevention and control work became normal. After resuming classes in the fall of 2020, colleges and universities took restrictions such as not going out unless necessary, which caused obstacles to students' social and other activities, and they brought some emotional distress and negative impact. The detection rate of sleep problems, anxiety, and depression among college students has increased significantly in the fight against the epidemic.<sup>3</sup> Therefore, it is urgent to pay attention to the health problems of college students and establish an excellent physical and mental state for them. It is of great significance for universities to carry out mental health education in a particular period to understand the mood and sleep status of college students during the epidemic.

Physical exercise has a significant effect on improving individual sleep quality. Logistics regression analysis found that the probability of sleep quality problems in people who regularly participate in physical activity is much lower than in people who sit for a long time.<sup>2</sup> The cross-sectional survey showed that physical activity was significantly correlated with sleep quality.<sup>4</sup> After adjusting for age and other confounding factors, it is found that the incidence of psychological problems in the group with heavy exercise was much lower than that in the group with light exercise.<sup>5-7</sup> Therefore, in the context of the normalization of campus epidemic prevention and control, this paper takes college students as the research object and explores the influence of physical exercise on college students' mood and sleep quality, aiming to provide a reference for improving college students' sleep quality, regulating individual mood and promoting their healthy development in particular periods.

## METHODS

### Participants

From March to June 2021, 2200 students were randomly selected for a questionnaire survey, including 1249 males and 951 females. We send out 2200 questionnaires, and 1983 valid questionnaires were collected, with an effective rate of 90.1%, including 1086 males and 897 females. The age range is from 18 to 24, including 1649 undergraduates and 334 postgraduates.

### Measures

The questionnaire consisted of four parts: basic information questionnaire, physical activity rating scale, Pittsburgh Sleep Quality Index scale, and mood state Scale.

1. Basic information mainly includes gender, age, major, grade, and other essential information;

2. To investigate the physical exercise of college students, the Chinese version of the physical activity Rating Scale revised by Liang Deqing et.al. The scale involves three indicators, including frequency, time, and intensity of physical exercise,<sup>8</sup> each of which is scored at five levels, with intensity and frequency being measured from "1-5" points and time from "0-4" points. The calculation formula of exercise amount is "intensity × time × frequency," and the score range of the scale is "0-100 points". According to relevant research, the level of physical activity of college students is divided into: "≤19 is classified as a small amount of physical activity (insufficient

physical exercise), 20-42 is classified as medium amount of physical activity, ≥43 is classified as a large amount of physical activity";

3. To evaluate the current sleep situation of college students, the Pittsburgh Sleep Quality Index compiled by Liu Xianchen et.al. The scale consists of 7 dimensions, including subjective sleep time, and each size is scored at four levels, with 0 to 3 points respectively.<sup>9,10</sup> The sum of all dimensions is the total score of sleep quality, and the score ranges from 0 to 21 points. The retest reliability of the scale was 0.85;

4. To study emotional state and the relationship between emotion and motor efficiency, the Mood State Scale adapted by Zhu Baili was adopted. The scale has 40 adjectives, including seven dimensions of tension, anger, fatigue, depression, energy, panic, and sense of self-esteem. The scale is scored at five levels, and the corresponding score is 0 to 4.<sup>11,12</sup> The internal consistency coefficient of the scale was 0.75.

### Data Analysis

SPSS 21.0 software was used to analyze the obtained data. With the consent of the scientific research department of the CAUC, the research does not collect the specific information of the students and does not have any influence on the individual students. The results of the data are used as guidance for physical exercise only.

## RESULTS

### Physical exercise of college students

The scores of male students in physical exercise intensity were significantly higher than that of female students ( $t = -2.869$ ,  $P = 0.003$ ), more male students chose high-intensity physical exercise than female students. The score of female students in the physical exercise frequency dimension is higher than that of male students ( $t = 2.084$ ,  $P = 0.039$ ), and the frequency of female students participating in physical exercise is higher than that of male students, (Table 1)

The score of college students' physical exercise is classified according to the standard of physical exercise amount. The results showed no significant difference in the amount of physical activity between male and female students. 1125 students had a small amount of physical activity, accounting for 56.73% of the total number of students. 645 people participated in moderate exercise, accounting for 32.54% of the total number; 213 people participated in the high activity, accounting for 10.73% of the total. The number of participants in heavy activity was significantly lower than that in light exercise and moderate exercise, and the number of boys in moderate exercise was considerably higher than that of girls.

### Sleep quality of college students

In this study, according to liu Xianchen's classification standard, namely, the students with PSQI scores > 7 were identified as having sleep quality problems. After statistical analysis, there were 1,860 students without sleep quality problems, accounting for 93.8% of the total, and 123 students with sleep quality problems, accounting for 6.2% of the total. Independent sample T-test was conducted on the overall PSQI scores and various factors of male and female students. The results showed no significant difference between male and female students in sleep quality scores and multiple factors.

Table 1. Physical exercise score.

	M±SD			T	P
	Male	female	total		
exercise intensity	3.35±0.86	2.98±0.92	3.17±0.91	-2.869	0.003**
exercise time	3.11±0.83	3.17±0.77	3.14±0.76	0.567	0.584
exercise frequency	3.16±0.91	3.37±0.86	3.26±0.83	2.084	0.039*
exercise score	30.34±10.02	29.93±11.25	30.13±10.59	-0.290	0.772

Note: \*p < 0.05, \*\*p < 0.01.

## Emotional state of college students

The mood scale is divided into seven dimensions, among which the higher the score of tension, anger and other five dimensions, the worse the emotion control ability; the higher the score of self-esteem and energy, the better the emotion control ability. Total Mood Disturbance (TMD) = negative emotion score - positive emotion score + 100. The higher the TMD score is, the worse the emotional state is, and the mood is more depressed and confused. On average, male college students have slightly higher TMD scores than female students. Regarding emotional state, there was no significant gender difference in the scores of 7 dimensions and TMD. Among them, the scores of girls' self-esteem, tension, anger and panic were slightly higher than that of boys, while the scores of fatigue and energy were lower than that of boys.

## The relationship between physical exercise, mood and sleep quality

The correlation analysis showed that physical exercise was negatively correlated with the scores of mood and sleep quality ( $R = -0.252, P < 0.01$ ;  $R = -0.158, P < 0.01$ ), sleep quality was significantly correlated with mood ( $R = 0.393, P < 0.01$ ). (Table 2) To further explore the impact of sleep quality on mood. Sleep quality as the independent variable, mood as the dependent variable, regression analysis. The results showed that sleep quality had a significant positive effect on mood score ( $B = 1.489, P < 0.01$ ).

To more clearly and accurately observe the influence of physical exercise on sleep quality and mood of college students, the mean value test of dependent variables was carried out on the sleep index scale and mood scale. The results showed that PSQI score and TMD score of moderate exercise group and high exercise group were significantly lower than those of light exercise group ( $F = 56.112, P = 0.000$ ;  $F = 12.439, P = 0.000$ ). There were significant differences in subjective sleep time, sleep latency, sleep duration, sleep disorder, use of hypnotic drugs and daytime dysfunction ( $F = 3.209, P = 0.042$ ;  $F = 3.129, P = 0.046$ ;  $F = 5.758, P = 0.004$ ;  $F = 13.261, P = 0.000$ ;  $F = 5.899, P = 0.003$ ;  $F = 7.656, P = 0.001$ ). There were significant differences in physical activity in energy and depression ( $F = 6.719, P = 0.001$ ;  $F = 7.768, P = 0.003$ ). On average, the scores of PSQI and TMD of the heavy exercise group were lower, and the scores of the light exercise group were the highest, indicating that the sleep quality and emotional state of heavy exercise group were better than those of the light exercise group.

Taking physical exercise as an independent variable and sleeping quality and mood score as a dependent variable, regression analysis was carried out. The results showed that physical exercise had significant negative influence on sleep quality and mood score of college students ( $B = -0.35, P < 0.01$ ;  $B = -0.083, P < 0.05$ ).

## DISCUSSION

Among the 1983 people investigated in this study, 56.73% of students do not have enough physical exercise, and only 14.54% of students do physical exercise regularly. Colleges and universities after the start of delay to semi-closed management of school students, although the students

**Table 2.** Mean value, standard deviation and correlation of variables.

	M	SD	1	2	3	4	5	6	7
Sex	1.52	21.5	1						
Age	21.06	2.06	0.001	1					
Profession	2.51	1.06	-0.054	0.028	1				
Grade	2.82	1.34	0.034	0.482**	0.038	1			
Exercise	30.12	10.59	0.021	-0.067	-0.094	0.084	1		
PSQI	4.99	1.48	0.009	0.118	0.086	0.093	-0.253**	1	
TMD	110.97	5.61	0.033	-0.019	0.063	-0.086	-0.158**	0.393**	1

Note: \*  $p < 0.05$ , \*\*  $p < 0.01$ .

agree with the positive role of physical exercise, but this result shows that college students take part in physical exercise less than three times a month on average, exercise the time less than 30 minutes, more than half of the students' physical exercise intensity is low, has yet to reach the recommended amount of physical exercise. Therefore, it is necessary to strengthen health education, establish physical exercise awareness, and guide students to insist on regular physical exercise based on personal epidemic prevention and protection measures.

In this study, the detection rate of sleep problems among college students was 13.7%, and there was no gender difference in PSQI and factor scores. Consistent with fang Yongwen et al.'s conclusion, college students of different genders have no difference in sleep quality. Regarding emotional state, the average TMD score of college students was 110.97, the TMD score of male students was slightly higher than that of female students, and there was no gender difference. In the context of epidemic prevention and control, college students, both male and female, face a lot of pressure from study, employment, and interpersonal relationships while taking good personal protection, which may cause sleep problems and negative emotions.

The higher the sleep score, the worse the sleep quality, while the higher the mood score, the weaker the emotion control ability. Therefore, physical exercise has a significant positive impact on the sleep quality and emotions of college students, and the college students who actively participate in physical exercise have better sleep quality and emotional state. Students who participated in intense physical exercise frequently had better sleep patterns, and college students who did not frequently had higher rates of light sleep and a higher risk of psychological problems. It can be seen that regular and moderate physical exercise can not only improve the level of physical function, and improve sleep quality, but also regulate destructive emotions, which plays a significant role in improving the mental health level of college students.

Physical exercise has a positive effect on the sleep quality and mood of college students. The results show that the proportion of emotional problems and sleep disorders in students who do a lot of exercises is significantly lower than that in students who do a lot of exercises, indicating that scientific and effective exercise can effectively improve the sleep quality of college students, and regulate depression, anxiety, and other bad emotions, and play a positive role in promoting the physical and mental health development of college students. In the process of physical exercise, the secretion of dopamine in the brain can increase, resulting in the improvement of brain function and effective regulation of mood. Therefore, during the prevention and control of the epidemic, the school can improve the enthusiasm of college students to participate in physical exercise and form the habit of regular physical exercise through publicity and education, guidance, and supervision.

The more severe the sleep problems, the less able they were to control their emotions. Sleep quality is significantly negatively correlated with depression, anxiety, and other negative emotions. People with poor sleep quality will have more negative emotions and less positive emotions, and high-quality sleep will produce more positive emotions.<sup>13</sup> In addition, sleep quality is related to mood, with poor sleep quality leading to decreased positive emotions and increased negative emotions. Lack of sleep for a long time will make people more likely to fall into depression, anxiety and other negative emotions, and they may give up social activities, and physical exercise, which will further lead to the generation of negative emotions, and fall into a bad cycle of sleep problems and negative emotions.

## Limitations

The COVID-19 pandemic has changed the way college students study and live, which has led to some psychological problems. Due to the

lack of references, short survey time, small number of selected samples, and limited time and space in the selected exercise items and content, there are bound to be deficiencies in the overall operation. It is expected that the investigation time and scope can be expanded in the future research process to avoid the bias caused by the number of samples.

## CONCLUSIONS

The overall situation of physical exercise, sleep quality and emotional state of college students is better. The intensity of physical exercise of boys is higher than that of girls, while the frequency of physical exercise of girls is higher than that of boys. There was no gender difference in sleep quality and mood of college students. Physical exercise is closely related to the sleep quality and mood of college students, and the proportion of emotional problems and sleep disorders of students who do a lot of physical exercise is lower than that of students who do a lot of physical

exercise. Sleep quality is related to mood, and the more severe the sleep problems, the less able they are to control their emotions.

In the prevention and control of the epidemic on campus, we should pay attention to sleep quality and emotional problems of college students, the positive role of physical exercise should be vigorously publicized, and college students should be encouraged to actively participate in physical exercise by organizing campus sports activities and other forms. We should timely understand the mental health trends of college students under the epidemic prevention and control, carry out the effective and timely psychological intervention, respect and cherish life more, and improve the physical and mental health of college students.

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