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Impact of the COVID-19 Pandemicon Physical Health-Related Indexes of College Students in China

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Abstract

Background: This study aims to analyze the changes in the physical health-related indexes of college students before and after the coronavirus disease 2019 (COVID-19) pandemic and to provide a reference for strengthening the attention given to physical health during exceptional periods. **Methods:** Taking the physical fitness test index data of 2004 college students as the research object, the physical fitness test index and vision index results in 2020 and 2021 were selected for statistical analysis and evaluation. **Results:** Physical fitness test failure in 2021 increased by 1.34%. The physical fitness test score in 2021 decreased compared to the physical fitness test's overall score in 2020. The results showed statistical significance in the vital capacity (VC), 50 m run, standing long jump (SLJ), sit and reach (SR), endurance quality (800/1000 m run), vision index, left eye vision index, and right eye vision index tests. However, there were no significant changes in body mass index (BMI) and strength quality (pull-ups/1 min sit-ups). **Conclusion:** During the COVID-19 pandemic, changes in college students' lifestyles have had varying degrees of negative impact on their physical functions, physical fitness, and athletic ability. These effects may be further exacerbated, leading to weakened immunity, increased risk of chronic diseases, and increased risk of damage to the body's various organs and tissues. Colleges and universities, families, and relevant departments should actively take effective measures to promote college students' physical activity (PA) and to improve their physical condition and quality of life during the pandemic.

Keywords:COVID-19; college students' lifestyles; physical fitness index; physical activity; well-being

Introduction

At the end of 2019, the COVID-19 pandemic broke out in China and spread to various countries and regions worldwide. On 30 January 2020, the World Health Organization (WHO) announced that the COVID-19 pandemic was a public health emergency of international concern[1]. COVID-19 has the characteristics of strong infectivity, wide spread, a long incubation period, and diverse clinical manifestations. It has a serious impact on the safety of people's life and physical health. To prevent the spread of the pandemic, the Chinese Ministry of Education stipulated that they should postpone the re-opening of schools. It was necessary to reduce going out and to encourage studying at home. Lockdown has changed the lifestyle of college students. "Lifestyle in a broad sense refers to the characteristics and manifestations of life activities that meet their own needs

formed by people under certain social conditions and the guidance of certain values; Lifestyle in a narrow sense refers to the characteristics of people's daily life activities and its manifestations, which mainly include: work and study activities, basic physiological needs activities, leisure activities, and other life activities" [2]. Due to the tremendous pressure and isolation caused by the COVID-19 pandemic, bad lifestyle choices have intensified, such as irregular diets, excessive calorie intake, smoking, and alcoholism. Millán-Jiménez et al. [3], in a survey of 188 undergraduates during the lockdown period, found that 56% had anxiety, 49% had depression, 38% had weight gain, and 11.7% needed medical assistance. In addition, 62% of people drank alcohol, smoked, used marijuana, or a combination. During the COVID-19 pandemic, the increased use of televisions, computers, and mobile devices are some of the factors that have led to a lack of physical exercise. Regulation undoubtedly poses a major challenge to maintaining physical activity (PA). College students are the talent pool for the future development of a country.

The changes in lifestyle and the tremendous psychological pressure have impacted all aspects of college students' lives. Sedentary behavior, lack of PA, and disordered work and rest have adverse effects on college students' physical health. Physical inactivity prevalence refers to the failure to perform enough daily PA to meet PA and exercise guidelines (adults should perform at least 150 min of moderate aerobic PA per week or at least 75 min of vigorous PA per week, while children 5 to 17 years old at least 60 min of moderate-to-vigorous PA per day) [4].

Under these circumstances, college students can have some negative effects on their emotional state and feelings, such as experiences of anxiety, depression, loss, and helplessness. They also cause behavioral disorders and physical discomfort, such as insomnia, fatigue, chest tightness, headache, and appetite loss. If they cannot properly resolve these, they will seriously affect their physical and mental health [5]. Data show that the immune system can be significantly affected by depression, anxiety, and post-traumatic disorders [6]. Adamu et al. [7] found that lower physical fitness is a risk factor that hinders PA, and individuals face an increased risk of chronic diseases. Katzmarzyk and Lear [8] mentioned that behaviors such as a sedentary lifestyle are associated with an increased risk of chronic diseases. Ng et al. [9] mentioned that the incidence of chronic diseases shows an increasing trend in the young population. The increase in chronic diseases can also reduce academic performance [10]. Woods et al. [11] proposed that insufficient PA may reduce the organ system's ability to resist viral infections and may increase the risk of immune, respiratory, cardiovascular, musculoskeletal, and brain damage.

Many outstanding experts and scholars in China and abroad have proposed that PA can positively impact physical and mental health. "Sports lifestyle in a broad sense refers to the characteristics and manifestations of sports activities that meet their own needs formed by people under certain social conditions and the guidance of certain values" [2]; "Sports lifestyle in a narrow sense refers to the characteristics and manifestations of people's daily sports practice" [2]. A consensus in the sports immunology community shows that continuous moderate-to-vigorous physical exercise for an hour or less is beneficial to the immune system's function and provides the possibility to reduce the risk of viral respiratory infections in the general population [12,13]. Research on incorporating exercise programs into cardiac rehabilitation programs has shown that cardiovascular mortality and hospitalization rates have been reduced [14].

Moreover, patients with myocardial infarction who participated in the three to six-month cardiac rehabilitation program increased aerobic capacity, improved their quality of life, and reduced the risk of cardiac events [15,16]. Nieman and Wentz [17] summarized epidemiological research evidence in their review, confirming the benefits of participating in PA on the human body. Studies have shown that compared to the lowest activity group, the high-activity group has a lower risk of illness [18,19], a reduction in the number of sick days [20], and a lower risk of the common cold [21]. Durstine et al. [22] pointed out that the results of PA and exercise in children and adults are increased functional function and muscle strength, reduced inflammation, increased HDL-cholesterol, and weight loss. A lifestyle

incorporating sports will provide participants with a way to relax and distance themselves from daily stress and trivial matters. Shen [23] proposed that physical exercise can enhance college students' mental health, reduce anxiety, remove mental disorders, and improve positive emotions. The research of Kandola et al. proposed that exercise training can effectively reduce depression and protect nerves [24]. PA and exercise are brain-derived neurotrophic factors (BDNFs) [24]. Studies on daily steps and other exercise measures have shown that regular PA can promote cardiovascular health, and people with higher fitness levels have better health [25,26]. Simpson et al. [27] found that PA and exercise can improve the immune system and can help the body resist infectious diseases, reducing the infection rate of diseases. Zhao and Zhang [28] proposed that moderate physical exercise can accelerate the metabolism and circulation in college students' bodies and can enhance their physical fitness and self-immunity. Anderson and Durstine [29] mentioned that increasing PA and exercise is associated with reducing the risk of chronic diseases. From the perspective of preventing or treating diseases, PA and regular exercise can improve the quality of life and play an important role in extending life [30].

Gao Gang [31] mentioned, in his research, that, while Chinese adolescent students have continued to improve their body shape index for more than 20 years, aerobic endurance, muscle strength, and muscle endurance indexes have declined to varying degrees, and the obesity trend has continued to spread. In-depth research on physical fitness evaluation is of great practical significance for promoting the healthy development of Chinese young people. The physical health of college students is of far-reaching significance to the country's future construction and development. The COVID-19 pandemic has affected and changed the way of life of college students. Faced with this public health emergency, it is bound to impact the physical health of college students. Such pandemics may become normal in future life. To understand the changes in college students' physical health before the pandemic and in the post-pandemic period, we selected a specific period's physical fitness test data in early 2020 and early 2021 for longitudinal research. Such a data comparison can directly reflect the changes in the various indexes of college students' physical health, triggering one to think about the possibility of normalizing the pandemic in the future and how to ensure the physical health of college students effectively.

Methods

Research Design

This study used a pretest and posttest approach to evaluate college students' physical fitness index changes during the COVID-19 pandemic. This study selected participants' physical fitness test index data at two special nodes in early 2020 and early 2021. After the outbreak of the COVID-19 pandemic, the government implemented lockdown restrictions to limit the spread of the COVID-19 pandemic. The study lifestyle of college students has changed, and home isolation has become the norm. After the pandemic had been basically controlled, college students resumed their normal school life. During this special period (the early 2020 to early 2021), college students' physical fitness index changes are worthy of research and attention.

Participants

This study selected 2160 college students' physical fitness test index data in 2020 and 2021. Among the 2160 college students, we excluded 100 college students due to transfer or dropout, and excluded 56 college students due to missing data. The data in early 2020 and early 2021 were from the same sample. This study's final sample size was 2004 (Male=1738, Female=266)—inclusion criteria: Age ≥18; currently studying at the college; valid physical fitness test results (no missing data). This study was conducted in accordance with the Declaration of Helsinki. The study was approved by Civil Aviation Flight University of China (CAFUCREC_1115).

Measurement

According to the "national student physical health standard" [32], there are seven indexes to evaluate college students' physical fitness: Body mass index (BMI), vital capacity (VC), 50 m run, standing long jump (SLJ), sit and reach (SR), 800/1000 m run, and pull-ups/1 min sit-ups. The standard score is composed of the sum of the product of each individual index

score and the weight, and the full score is 100 points. Individual index weight: BMI (15%), VC (15%), 50 m run (20%), SLJ (10%), SR (10%), 800/1000 m run (20%), pull-ups/1 min sit-ups (10%). The grade evaluations were: A total score of 90 points and above is considered excellent; a total score of 80–89 points is good; a total score of 60–79 points constitutes a pass; a total score of less than 60 points is a fail. In addition, according to the notice of the General Office of the Ministry of Education of China on strengthening physical health management, vision monitoring is included in the physical health test as an inspection item; however, it is not included in the physical health test score [33].

BMI reflects the relationship between height and weight: BMI = weight (Kg) / height $(m)^2$; the WHO regards BMI as an essential index to judge the degree of fatness, but the BMI stratification standards are different. "The Working Group of Obesity in China" (WGOC) is based on the characteristics of the Chinese people's standards and uses the following: BMI < 18.5 for "underweight," 18.5 ≤ BMI < 24.0 for "normal weight," 24.0 ≤ BMI < 28.0 for "overweight," and BMI ≥ 28.0 for "obesity" [34]. The BMI standard in the physical fitness test of college students is that boys' BMI ≤ 17.8 is "low weight," 17.9 ≤ BMI ≤ 23.9 is "normal," 24.0 ≤ BMI ≤ 27.9 is "overweight," and BMI ≥ 28.0 is "obese," while girls' BMI ≤ 17.1 is "low weight," 17.2 ≤ BMI ≤ 23.9 is "normal," 24.0 ≤ BMI ≤ 27.9 is "overweight," and BMI ≥ 28.0 is "obese" [32]. "Vital capacity (VC) refers to the sum of the amount of air that a person can exhale after one inhalation without a time limit. It is the Maximal voluntary ventilation (MVV) of the lung during one breath of the human body" [35]. VC is a mandatory index in the physical fitness test.

The 50 m run mainly reflects the quality of speed, which is the basic ability of human movement and the ability to complete exercise quickly in a short time. SLJ mainly reflects the explosive power of the lower limb muscles. SR reflects the development level of the stretching ability and flexibility of body joints, muscles, and ligaments. The 1000 m run for boys and the 800 m run for girls mainly reflect endurance quality, which is a person's ability to persist in long-term exercise. Within the specified distance, the shorter the elapsed time, the better the college students' endurance quality and, on the contrary, the worse the endurance quality. Respiratory function, muscular endurance level, and cardiovascular function can be reflected by endurance running. Pull-ups reflect the level of strength development of the upper limbs, and subjects need to overcome their own body weight. Sit-ups are an effective evaluation method that mainly reflects the strength of the waist and abdominal muscles and muscle endurance. Vision refers to the ability of the retina to distinguish images.

The data collection of BMI, VC, SR, and 1 min sit-ups in the physical fitness test used the Tsinghua Tongfang physical fitness tester (TONGFANG HEALTH TECHNOLOGY (BEIJING) CO., LTD. CHINA). The instrument models were CSTF-5000-ST, CSTF-5000-FH, CSTF-5000-TQ, and CSTF-5000- YW. The data of the 50 m run, 800/1000 m run, SLJ, and pull-ups were tested and recorded by the physical education teacher following the standards. The instruments used were a stopwatch and tape measure, as well as a vision testing tool, which was a logarithmic visual acuity chart (GB 11533—1989,China).

2.4. Data Analysis

All data were statistically analyzed using Microsoft Excel 2003 (Microsoft Corporation, USA) and SPSS 20 (IBM SPSS Statistics, USA), and the paired-samples *t*-test was used to compare and analyze the individual index scores and total scores of the research participants in early 2020 and early 2021. For the test results, $p < 0.05$ was considered statistically significant, while $p > 0.05$ was not statistically significant. The tables and graphs were generated by Microsoft Excel 2003.

Results

Analysis of the College Students' Physical Fitness Test Results

We analyzed the overall evaluation grade of college students' physical fitness test, as shown in Table 1. The total pass rate (including excellent, good, and pass) of the sample before the pandemic in 2020 was 88.17%, compared with the total pass rate of the sample during the post-pandemic period (including excellent, good, and pass) being 86.83%; the pass rate dropped by 1.34%. The fail rate rose from

11.83% to 13.17%. One situation is that the college students who failed in 2020 still failed in 2021, and some students who fell from the pass area to the fail area were added; in another case, out of all of the college students who failed in 2020, some entered the pass area, but more college students in the pass area fell into the fail area. In either case, the physical health of college students who fail the test is more worthy of attention. Figures 1 and 2 show the overall evaluation grade distribution of college students' physical fitness tests in 2020 and 2021.

Table 1. Overall evaluation grade analysis.

Years		Excellent	Good	Pass	Fail	Total
2020	Sample size	11	172	1584	237	2004
	Percentage	0.55%	8.58%	79.04%	11.83%	100%
2021	Sample size	12	197	1531	264	2004
	Percentage	0.60%	9.83%	76.40%	13.17%	100%

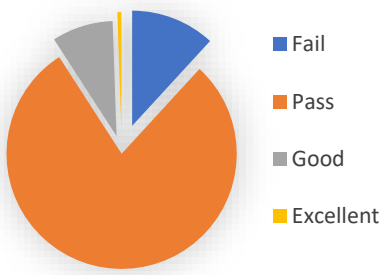

Figure 1. 2020 evaluation grade distribution.

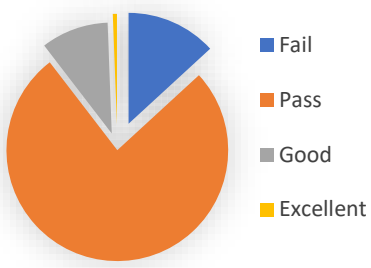

Figure 2. 2021 evaluation grade distribution.

fitness tests in 2020 and 2021 (p <0.01), as shown in Table 2.

There were statistically significant differences between the average total scores of the physical

Table 2. Comparative statistical results of the total scores of physical fitness tests in 2020 and 2021.

Paired Differences								
				95% Confidence Internal of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-Tailed)
Physical fitness test total score 2021– physical fitness test total score 2020	−0.39	4.37	0.10	−0.58	−0.19	−3.95	2003	0.000

changes in the scores of the two years intuitively and clearly.

Figure 3 shows the mean ± standard deviation of the total score of the physical fitness tests in 2020 and 2021. From this graph, we can compare the

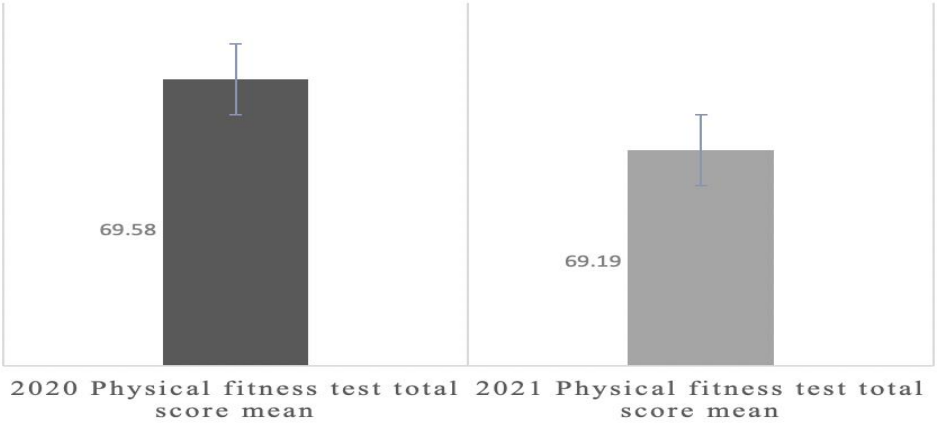

Figure 3. 2020 and 2021 total score and mean ± standard deviation.

There was no statistically significant difference in the BMI scores of the college students in 2020 and 2021 (p >0.05), as shown in Table 3.

Comparative Analysis of the Body Mass Index (BMI) Scores

Table 3. Comparative statistical results of each index score of the physical fitness tests in 2020 and 2021.

Paired Differences								
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-Tailed)
BMI score 2021–BMI score 2020	0.01	0.89	0.02	−0.03	0.05	0.53	2003	0.597
VC 2021–VC 2020	−0.23	1.51	0.03	−0.29	−0.16	−6.74	2003	0.000
50 m 2021–50 m 2020	−0.24	1.28	0.03	−0.30	−0.19	−8.47	2003	0.000
SLJ 2021–SLJ 2020	−0.13	0.84	0.02	−0.17	−0.09	−6.84	2003	0.000
SR 2021–SR 2020	0.13	1.00	0.02	0.09	0.18	5.96	2003	0.000
800/1000 m 2021–800/1000 m 2020	−0.42	1.69	0.04	−0.50	−0.35	−11.26	2003	0.000
Pull-ups/1 min sit-ups 2021–pull-ups/1 min sit-ups 2020	0.04	1.97	0.04	−0.05	0.12	0.85	2003	0.393

Comparative Analysis of the Vital Capacity (VC) Scores

It can be seen from Table 3 that the comparison of VC index scores in 2020 and 2021 shows statistical significance (p <0.05) and an overall decline in the VC scores of the college students in 2021.

It can be seen from the mean ± standard deviation of VC in 2020 and 2021 in Figure 4 that the mean VC in 2021 had declined, and the difference was very significant compared with 2020. This downward trend is not conducive to the physical health of college students.

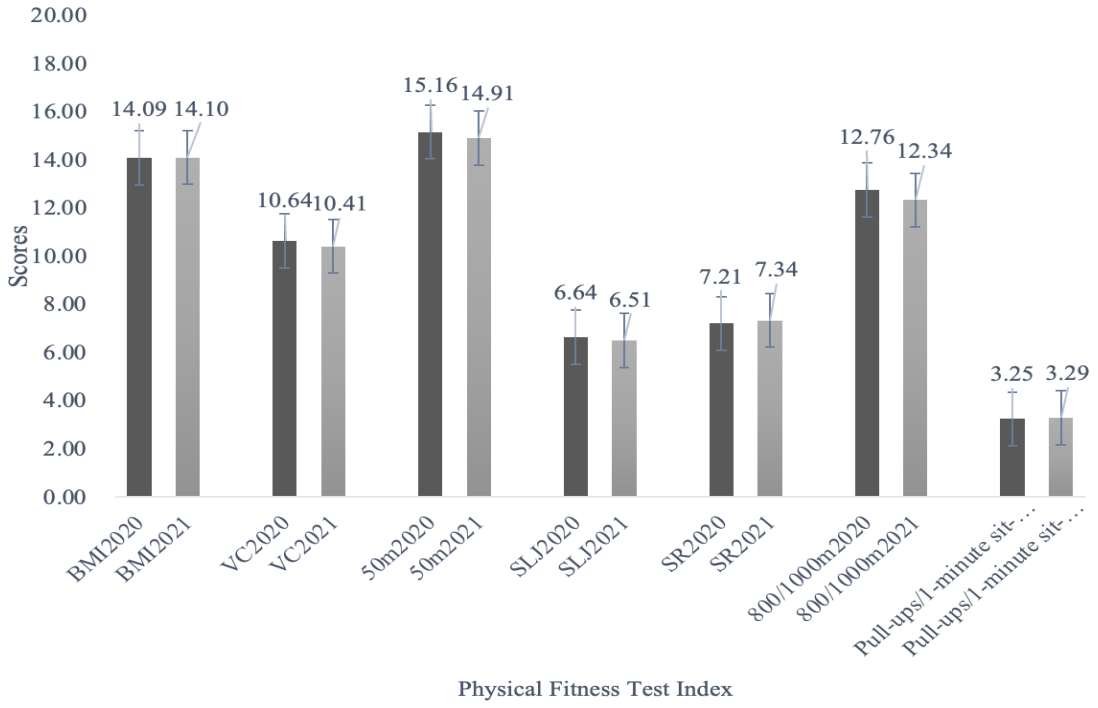

Figure 4. 2020 and 2021 index scores and mean ± standard deviation

2020 was 6.64 points, while in 2021, it was 6.51 points.

Comparative Analysis of the Sit and Reach (SR) Scores

The SR index scores in 2021 were higher than those in 2020 and show statistical significance (p <0.05), as shown in Table 3. The average SR score in 2020 was 7.21 points, which was lower than the average SR score in 2021 of 7.34 points.

Comparative Analysis of the Endurance Quality (800/1000 m Run) Scores

The comparison between the endurance quality scores of the college students in 2021 and 2020 dropped significantly, showing statistical significance (p <0.05), as shown in Table 3. The average endurance quality score in 2020 was 12.76 points, while in 2021, it was 12.34 points. As shown in Figure 4, the interquartile range of the two sets of index data is obvious.

Comparative Analysis of the Strength Quality (Pull-Ups/1 Min Sit-Ups) Scores

It can be seen from Table 3 that there was no statistical significance in the index scores of

Comparative Analysis of the 50 m Run Scores

The comparison of the index scores of the 50 m run in 2020 and 2021 shows statistical significance (p <0.05), as shown in Table 3. The average score for the 50 m run in 2020 was 15.16 points, while in 2021, it was 14.91 points, as shown in Figure 4.

3.5. Comparative Analysis of the Standing Long Jump (SLJ) Scores

As shown in Table 3, the comparison of the SLJ index scores in 2020 and 2021 shows statistical significance (p <0.05). The average SLJ score in strength quality (pull-ups/1 min sit-ups) in 2020 and 2021 (p >0.05).

Both in 2020 and 2021, the strength quality (pull-ups/1 min sit-ups) index scores in the college students' physical fitness tests failed, and there was a large gap in the pass standard, as shown in Figure 4.

Comparative Analysis of the Vision Index

The vision index visually showed the impact of home-based online lessons during the COVID-19 pandemic. There was a statistically

significant difference between the left eye vision index in 2020 and that in 2021 (p<0.01). There was also a statistically significant difference between the right eye vision index in 2020 and that in 2021 (p<0.01), as shown in Table 4.

Table 4. Comparative statistical results of vision index (left eye/right eye) in 2020 and 2021.

Paired Differences								
				95% Confidence Internal of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-Tailed)
Left eye vision 2021–left eye vision 2020	−0.02	0.23	0.01	−0.03	−0.01	−3.40	2003	0.001
Right eye vision 2021–right eye vision 2020	−0.01	0.23	0.01	−0.02	−0.00	−2.86	2003	0.004

of the left and right eye vision indexes in 2020 and 2021. The decline in the college students' vision index is inseparable from other factors such as online lessons, a lot of time spent looking at mobile phones, and using computers during the COVID-19 pandemic.

The average left eye vision index for the college students in 2020 was 4.70, while in 2021, it was 4.68; meanwhile, the average right eye vision index for the college students in 2020 was 4.70, while in 2021, it was 4.69. Figure 5 shows the comparison of the mean ± standard deviation

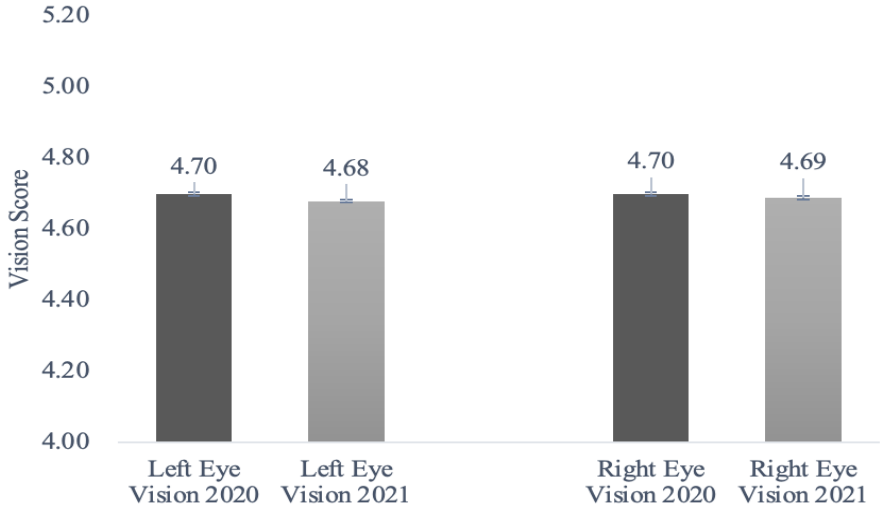

Figure 5. Mean vision (left eye/right eye) ± standard deviation in 2020 and 2021.

This study shows that the physical fitness test fail rate of college students in 2021 increased compared with 2020. The total physical fitness test scores declined compared with 2020, and there were statistically significant differences. Among the other indexes, BMI and strength quality index (pull-ups/1 min sit-ups) showed no significant changes, while the SR index significantly improved. The VC, 50 m run, SLJ, and endurance quality (800/1000 m run) indexes all decreased and showed statistical significance. The college students' vision index of the left and right eyes both decreased and showed statistical significance.

Discussion

The COVID-19 pandemic is a public health emergency, which has adversely affected people's physical and mental health to varying degrees. Xi Jinping mentioned, at a work deployment meeting, that the COVID-19 pandemic is the fastest spreading major public

health emergency, with the widest range of infections and the most difficult prevention and control since the founding of New China [36]. The COVID-19 pandemic has sounded the alarm for the public. Today, when public health emergencies occur frequently, the manner in which to effectively and rationally arrange life and strengthen physical exercise is a social issue that everyone should pay attention to. College students form a special group, and they are prone to stress responses when facing emergencies of public health. After the outbreak of COVID-19, college students' lifestyles have changed, altering their original pace of life. Indeed, PA is restricted: The national standard is to exercise at least 1 h a day and to participate in extracurricular physical exercises three times a week. The WHO recommends 150 min of moderate-intensity or 75 min of vigorous-intensity PA per week, or a combination of two or more muscle-building exercises per week [4]. It is difficult for college students to meet the above activity suggestions during the COVID-19 pandemic, and the physical health of college students deserves more attention.

A lifestyle that lacks PA can cause other problems, including circulatory system disorders, osteoporosis, arthritis, or other skeletal disabilities, decreased self-confidence, greater dependence on others, reduced opportunities and the ability for normal social activities, and an overall decline in life quality [37]. Lin and Xu [38]'s research results showed that after the outbreak of COVID-19, most students agreed with the importance of physical exercise, but there was a big gap between thinking and action. This is specifically reflected in the fact that the average number of physical exercise sessions per week and the time spent in physical exercises per day were lower than the national standards. This has been a common problem among college students during the COVID-19 pandemic.

Due to the impact of the COVID-19 pandemic, college students' lifestyles have changed, and studying at home and reducing outgoings has become the new normal. The pattern of PA has changed significantly. Sedentary behavior and reduced outdoor sports activities have led to an overall decline in physical fitness. In fact, college students' physical fitness has shown a gradual decline, and the physical fitness of college students has always been the focus of attention. The COVID-19 outbreak has wholly exposed the problem of the decline in the physical health of college students. While being highly concerning, formulating relevant policies to ensure sports activities and to raise physical exercise to a certain level and effective methods to adopt to improve the physical health of college students are issues that need to be solved urgently.Studies have shown that the level of individual obesity is inversely proportional to the level of physical fitness [39,40]. Compared with the normal population, adults who are overweight or obese have lower levels of physical health [41]. BMI has not changed significantly due to the impact of the pandemic. Sedentary lifestyles and a lack of PA are factors that trigger obesity, while psychological pressure and mental factors may lead to weight loss.

There has been no statistically significant change in BMI, and it is good to maintain a reasonable level. However, the causes of the pandemic and other adverse effects caused by a lack of PA still need further attention. College students were affected to varying degrees during the COVID-19 pandemic and were unable to perform adequate PA, which worsened their cardiopulmonary function and developed in a direction not conducive to physical and mental health. According to reports from epidemiology and longitudinal studies, incorporating PA into one's daily lifestyle and having higher cardiorespiratory fitness can reduce the risk of disease [42–44]. This also fully shows that moderate and reasonable PA is an important guarantee for promoting college students' physical health and maintaining good heart and lung function. In 2021, college students' speed quality declined significantly, which is consistent with the downward trend in the scores of several other test indexes that reflect physical function and ability.

The lack of PA caused by long-term home learning and sedentary behavior directly affects the deterioration of speed quality. Judging from the results of SLJ, the decline in scores is an inevitable trend because factors such as changes in PA patterns and sedentary lifestyles lead to a loss of muscle strength and lower limb strength, and the level of explosive power decreases. The SR index score increased

significantly, which may be related to changes in lifestyles and PA patterns after the outbreak of the COVID-19 pandemic. College students' PE courses have been changed to online learning. Different schools have different requirements for students' home exercises and different content formats. It is not easy to achieve the same supervision and requirements as outdoor exercises. Students' sports activities are even less effective. Most PE courses are based on theoretical studies and family sports, such as yoga, stretching exercises, and core training.

The improvement of flexibility may have a high correlation with the form of home exercise. The endurance quality result is predictable, as with other indexes of a decline in scores. The change in PA patterns during the COVID-19 pandemic, the decrease in outdoor sports, and the increase in sedentary behavior are the inevitable results of a decline in endurance quality. The cardiovascular function and cardiopulmonary function of college students are in a state of decline, which is a bad phenomenon. If the function is not improved, it will have a long-term adverse effect on college students' physical health. Regarding the strength quality index, college students appear to have completely ignored the strength quality exercises, which is very worthy of attention, whether it is a normal year or a pandemic year.

Due to different regions, the degree of changes in students' lifestyles and the impact on physical health caused by the pandemic is also different. Due to the limitation of conditions, the research on target populations in different regions can be further expanded in future research.

Students' physical fitness tests have become a national strategy in Europe, the United States, Japan, and Russia. By promulgating policies and decrees (guidance/funding) to attract social forces promoting participation, various grassroots groups, enterprises, and individuals have participated in students' physical fitness tests in their own ways and have achieved good results [45]. Various countries' governments attach importance to policy guarantees and organizational guarantees in students' physical fitness tests. Combining students' physical fitness tests and evaluations with the goal of "cultivating lifelong sports" has become a common concept in most countries across the world [45]. Countries worldwide have gradually realized that the fundamental way to solve students' low rates of physical fitness is to improve their lifestyles. Therefore, the evaluation index is no longer just for evaluating the physical fitness level, but also for paying more attention to the goal of "cultivating lifelong sports." Anderson and Durstine [29] mentioned that incorporating PA and exercises into daily life can bring multiple health benefits, promote social growth, and provide long-term chronic disease prevention and treatment while improving overall global health.

Daily PA can keep people healthy, and the human body can constantly perceive the internal environment and respond to changes in exercise [46]. It is not easy to intervene in college students' physical health from an individual perspective in the short term. It is necessary to take the campus as the environment for change, starting from a group perspective and changing the current mechanisms of PA, intervening in college students' physical and mental health by strengthening PA. We should learn from university sports systems in developed countries, construct a sports activity system suitable for domestic college students' development, and implement it at the legal level. Judging from the current situation, constructing a PA intervention system during a pandemic is necessary. This needs to be built on good daily PA to protect and improve college students' physical and mental health and to provide a long-term contribution to human society.

Conclusion

In short, this research showed that the changes in the lifestyle of college students during the COVID-19 pandemic have affected the relevant indicators of physical health, with such effects generally being negative. The changes to normal lifestyles and the lack of PA under the influence of the pandemic have directly led to this phenomenon.

Declarations

Ethics approval and consent to participate: This study was conducted in accordance with the Declaration of Helsinki. The study was

approved by Civil Aviation Flight University of China (CAFUCREC_1115). Informed consent was obtained from all subjects involved in the study.

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