

Analysis of Physical Fitness Differences among College Students before and after COVID-19

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Abstract. COVID-19 has not only had a profound impact on social and economic development, but also changed social lifestyles and values. Due to the prevention and control of the epidemic, people's demand for physical exercise has been limited to a certain extent, while the epidemic has increased the requirements for individual immunity, forming a contradiction. In this paper, the fitness tests of college students before and after COVID-19 were taken as samples, and the differences of physical tests in 2019 and 2021 were compared by t-test and non-parametric test. The study found that after the epidemic, the body shape of the college students deteriorated slightly, and the physical fitness tests significantly lower after gaining weight. In general, the decline of college students' physical fitness is not obvious after the epidemic, but it is a common phenomenon. Then put forward countermeasures and suggestions of optimizing physical exercise.

Keywords: college students, COVID-19, fitness test, comparative analysis

1. Introduction

Since the outbreak in early 2020, the COVID-19 epidemic has been effectively controlled in China, but it is still rampant worldwide. COVID-19 has not only had a profound impact on social and economic development, but also changed social lifestyles and values, such as people's emphasis on physical exercise and their perception of the meaning of life. During the epidemic, the Ministry of Education issued the "Notice on Coordinating the Prevention and Control of the New Coronary Pneumonia Epidemic in the Education System and Education Reform and Development", and pointed out that it is necessary to care about the physical and mental health of students and guide students to strengthen physical exercise. Schools at all levels encourage students to "suspend classes and keep practicing" through online physical education, push public accounts, assign exercise assignments, and cloud competitions. However, home physical exercise relies more on students' self-practice and teachers lack effective monitoring means.

Physical exercise is considered to be a purposeful and energy-consuming physical exercise behavior under the domination and control of people's own consciousness. Citizen has more leisure time as a result of home quarantine during the pandemic. Physical exercise can relieve anxiety, relax mood, and maintain the health, so as to improve the body's immunity to disease[1]. In the indicator system of sports modernization, the frequency, duration and intensity of exercise in sports behavior are important indexes to reflect the development degree of mass sports, and are also the main indicators for countries to judge "sports population" or "the number of people who regularly take part in physical exercise", as well as indispensable parameters for national economic and sports planning and management[2].

The level of physical health, especially the level of physical quality, has become an obvious shortcoming of college students' quality and a prominent problem hindering their overall development. The Report on the Development of Chinese Youth Sports (2015) - Youth Physical Fitness and Health Status also pointed out that the declining trend of college students' physical health has not been curbed [3]. Facing the dilemma that college students' physical fitness is too long to improve, scholars try to find a solution from the physical fitness test data of college students with the help of statistical tools. Zhang Qian, Shi Kaixuan et al. used the generalized additive model of smooth fitting curve and generalized estimation equation to analyze the

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relationship between BMI and health fitness index [4]. By variance analysis, Chen et al. found that there were significant differences in lung capacity, standing long jump, step test and grip body mass index at different body mass index levels, which had a great impact on the step test, but reduced the impact on the static display of force [5]. Zhao Guorui based on grey correlation model, explore the BMI's influence on the movement indicators, and to forecast the tendency in the students' physique[6]. All the above studies show that there is a deep relationship between Body Mass Index (BMI) and physical quality of college students.

Some scholars believe that the most important positive impact of physical exercise on pre-new coronary pneumonia is to enhance human immunity. From the perspective of exercise physiology, it is found that after a certain amount of physical exercise, the macrophages in the body will continue to increase, improve the vitality of natural killer cells, and continuously strengthen the resistance and self-healing function of the human body, thus greatly avoiding the invasion of infectious bacteria [7]. Most researches have confirmed that physical exercise also has a good effect on enhancing lymphocyte immune response, and regular physical exercise over a long period of time can improve the defense ability of the immune system [8]. When immunity enhancement, strain capacity and tolerance ability of the body will also get further improve.

Since the outbreak of new coronavirus pneumonia, home isolation, as the most common means of epidemic prevention and control, can effectively prevent the spread of the epidemic. However, studies have shown that home isolation during the epidemic may have a negative impact on individual mental health [9]. In response to this problem, physical exercise plays a great role in promoting mental health, reducing anxiety, exercisers can feel less tension, depression, anger and anxiety [10]. There are many differences in physical exercise intensity, duration, frequency and sports items, and it is found that there is a significant influence between exercise intensity and sense of meaning in life[11]. As a positive variable, sense of meaning of life plays an important role in enhancing public sense of happiness and health, helping people relieve negative emotions, release pressure and eliminate depression[12].

In the context of the frequent occurrence of global public health emergencies, this paper investigates the characteristics and influencing factors of college students' physical exercise behavior during the COVID-19 epidemic, identifies the impact of the epidemic on undergraduates' physical quality, provides the basis for their scientific physical exercise at home, and provides practical reference for carrying out targeted physical and mental exercise.

2. Physical Fitness Testing and Data Collection

2.1. Physical Fitness Test Project

Taking a comprehensive university in the central region as an example, a total of 8834 undergraduates of grade 2019 were selected as the measurement samples. Collection items included height, weight, bmi (body mass index) score, vital capacity, 50 m running, the standing long jump, sit-and-reach, 800 m / 1000 m running, sit-up / pull-up. Test items, converted to 0-100 points by standard comparison. The new coronavirus epidemic broke out in early 2020, and was basically in a stable prevention and control stage in 2020. Therefore, the physical fitness test data of 2019 and 2021 were used as pre-epidemic samples and post-epidemic samples. The changes of physical fitness of college students before and after the epidemic was identified by independent sample T test and nonparametric test.

2.2. Data Description

By filtering out the samples with 0 points and unknown items, 3101 items with complete data are obtained. Among them, there are 1361 boys and 1740 girls.

Table 1: Descriptive statistics

| | N | Min | Max | Mean | Std.Deviation | Skewness | Kurtosis | | |
|---------------------------|-------|-------|-------|---------|---------------|----------|-----------|-------|-----------|
| | Stats | Stats | Stats | Stats | Stats | Stats | Std.Error | Stats | Std.Error |
| Height (2019)Boys | 1361 | 156.1 | 197.5 | 174.232 | 5.9377 | .211 | .066 | .371 | .133 |
| Height (2019)Girls | 1740 | 146.9 | 186.3 | 163.170 | 5.4999 | .180 | .059 | .298 | .117 |
| Weight (2019)Boys | 1361 | 43.8 | 91.7 | 61.355 | 7.9705 | .717 | .066 | .552 | .133 |

| | | | | | | | | | |
|---------------------------|------|-------|--------|---------|---------|--------|------|-------|------|
| Weight (2019)Girls | 1740 | 38.2 | 109.9 | 54.173 | 7.3138 | 1.127 | .059 | 3.128 | .117 |
| Bmi (2019) Boys | 1361 | 60 | 100 | 95.89 | 8.196 | -1.553 | .066 | .714 | .133 |
| Bmi (2019)Girls | 1740 | 60 | 100 | 97.38 | 7.401 | -2.846 | .059 | 7.817 | .117 |
| Total score (2019) | 3101 | 49.4 | 99.7 | 75.824 | 6.2031 | -.214 | .044 | .454 | .088 |
| Total score (2021) | 3101 | 49.00 | 103.00 | 74.3922 | 6.86924 | -.184 | .044 | .252 | .088 |

Table 1 shows that most students are in normal shape. Girls' physique is better than boys. At the same time, the mean of total score in 2021 was lower than that in 2019, which basically indicated a slight decline in physical fitness after the epidemic. However, further comparative analysis of samples is needed to verify its significance.

2.3. Inspection Analysis

This paper aims to test the changes of college students' physical fitness before and after COVID-19. Physical fitness tests in 2019 and 2021 are independent tests carried out in the same place.

2.3.1. Test Physical Fitness Differences under Different BMI Parameters.

Label BMI groups [low weight, Normal, Overweight, Obesity] = [1,2,3,4].

Table 2: Independent sample statistics (Low Weight – Normal)

| Total score (2019) | BMI Number | N | Mean | Std.Deviation | Standard Error Mean |
|-------------------------|------------|--------|--------|---------------|------------------------|
| | 1 | 259 | 71.734 | 6.0473 | .3758 |
| 2 | 2616 | 76.615 | 5.9253 | .1158 | |

Table 3: Independent sample test (Low Weight – Normal)

| | The Levene test for equation variance | | t-test for Equality of Means | | | | | | |
|-----------------------------------|--|------|------------------------------|---------|--------------------|------------------|----------------------------|----------------|----------------|
| | F | Sig | t | df | Sig(two- sided) | Mean Variance | Standard error value | 95% confidence | |
| | | | | | | | | Lower limit | Upper limit |
| Equal variances assumed | .518 | .472 | 12.623 | 2873 | .000 | -4.8813 | .3867 | 5.6395 | -4.1231 |
| Equal variances not assumed | | | 12.414 | 309.102 | .000 | -4.8813 | .3932 | 5.6550 | -4.1076 |

As can be seen from the above table, the variance significance of Levin's variance isotropy test is greater than 0.05, so the variance is homogeneous, while the mean isotropy T test is less than 0.05, indicating that the physical fitness test level of students in the normal group is significantly higher than that of students with low body weight.

The statistics for other groups are shown in the following table.

Table 4: Independent sample statistics

| Total score (2019) | BMI Number | N | Mean | Std.Deviation | Standard Error Mean |
|-------------------------|------------|--------|--------|---------------|------------------------|
| | 3 | 203 | 71.898 | 5.5395 | .3888 |
| 2 | 2616 | 76.615 | 5.9253 | .1158 | |
| 4 | 23 | 66.504 | 5.8043 | 1.2103 | |
| 2 | 2616 | 76.615 | 5.9253 | .1158 | |
| 1 | 259 | 71.734 | 6.0473 | .3758 | |
| 3 | 203 | 71.898 | 5.5395 | .3888 | |

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| 4 | 23 | 66.504 | 5.8043 | 1.2103 |

The results of t-test of independent samples between groups 3 and 2, 4 and 2, 1 and 4, 3 and 4 showed that the significance of Levin's homogeneity test of variance >0.05 , and the mean homogeneity test <0.05 . However, the significance of levin variance isotropy test between group 1 and group 3 was greater than 0.05, and that of mean isotropy T test was greater than 0.05.

It can be concluded that the physical fitness test of the normal group is significantly higher than that of the overweight and obese groups; Low weight and overweight students performed almost the same; The physical fitness test of low weight students was higher than that of obese students, while the physical fitness test of obese students was lower than that of overweight students.

2.3.2. Matching Sample T Test.

The purpose of the two-paired sample t test is to use paired samples from two different populations to infer whether the mean values of the two populations are significantly different. H_0 assume that there is no significant difference between the two test scores.

Table 5: Paired sample statistics

| | Total score | Mean | Case | St. Deviation | St. Error Mean |
|------------------|-------------|---------|------|---------------|----------------|
| Paired 1 (boys) | 2019 | 75.885 | 1361 | 6.4889 | .1759 |
| | 2021 | 74.0013 | 1361 | 7.04748 | .19103 |
| Paired 2 (girls) | 2019 | 75.776 | 1740 | 5.9715 | .1432 |
| | 2021 | 74.6979 | 1740 | 6.71271 | .16092 |

Table 6: Paired samples of total physical fitness test scores in 2019 and 2021

| | Paired Difference | | | | | t | df | Sig.(2-tailed) |
|------------------|-------------------|---------------|----------------|----------------|---------|--------|------|----------------|
| | Mean | St. Deviation | St. Error Mean | 95% Confidence | | | | |
| | | | | Lower | Upper | | | |
| Paired 1 (boys) | 1.88332 | 6.09788 | .16529 | 1.55907 | 2.20757 | 11.394 | 1360 | .000 |
| Paired 2 (girls) | 1.07828 | 5.64172 | .13525 | .81301 | 1.34355 | 7.972 | 1739 | .000 |

As can be seen from the table, the physical fitness of both boys and girls has decreased, which is a common phenomenon.

2.3.3. Nonparametric Test.

Wilcoxon signed rank test results showed that the male sample size was 1361, standardized test statistic was -11.1111, and the progressive significance was 0.000. The sample size of female students was 1740, the standardized test statistic was -8.234, and the progressive significance was 0.000.

It can be seen that the physical fitness test of most boys (63%) decreased significantly; more than 55% of girls showed a significant decline in fitness tests.

3. Conclusion

In this study, the physical fitness test data of college students before and after COVID-19 outbreak were used as samples, and the T-test and non-parametric test were used to compare the physical fitness changes between 2019 and 2021. It was found that after the outbreak of COVID-19, BMI scores of college students showed a downward trend and body shape slightly worsened. When the students gained some weight, the fitness test decreased significantly. Generally speaking, the decline of college students' physical fitness is not obvious after the epidemic, but it is a common phenomenon, which is enough to attract social attention.

Due to the COVID-19 policy, most residents are forced to stay at home and do not exercise properly. The decline of college students' physical quality is only a microcosm. Therefore, in order to prevent and curb this social phenomenon, the following suggestions are put forward:

3.1. Strengthening Propaganda and Education

In the process of physical exercise for college students, it is necessary to continuously strengthen the publicity of health knowledge, behavior and lifestyle, and increase the publicity of healthy physical exercise by using multimedia, network and other means. Through effective publicity, college students realize the importance of health, consciously strengthen the pursuit of healthy physical exercise in the process of learning and life, and lay a solid foundation for college students to develop good physical exercise habits.

3.2. Reasonable Arrangement of Exercise Intensity

In the current situation of COVID-19, the exercise intensity should be controlled below medium intensity. If intense exercise or high intensity exercise is carried out, the function of human immune system will decline. Relevant departments need to design appropriate sports combinations for different intensity sports to provide college students with physical exercise.

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