

Effects of different intensity physical exercise on mental health of College Students

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Abstract

To investigate the effect of different intensities of physical exercise on the mental health of college students. This paper examines the impact of different intensities of physical exercise on the mental health of college students using the SCL-90 symptom checklist. The results of the intermediary effect analysis revealed that the P values of all indexes in the control group were greater than 0.05, indicating that there was no significant difference between the various indexes before and after the experiment and that the physical health did not improve significantly. The decrease of each index score in the control group was significantly less than in the experimental group, and the growth rate of paranoia reached 4.58 percent. Theoretically, the human body's psychological response and mental health will vary significantly depending on the intensity and frequency of physical activity.

Keywords: Physical exercise; College students; mental health; Intermediary effect

Introduction

The curriculum standard for "physical education and health" specifies that the curriculum should be conducive to stimulating students' interest in sports, developing the habit of adhering to physical exercise, forming the quality of courage, tenacity, and perseverance, and promoting healthy and harmonious development of students in physical, psychological, and social adaptability, to play an important role in improving the overall health level of the population. Exercise can strengthen the body, physique, life, mind, personality, and adaptability. Therefore,

physical education teachers should guide students to promote the mental health of elementary school students through varying intensities of physical activity and cultivate a new generation of high-caliber talent to meet the needs of society. During the celebration of the 95th anniversary of the founding of the Chinese Communist Party, General Secretary Xi Jinping emphasized that valuing youth means valuing the future. We must place a premium on youth service and physical and mental health care for young people (Ojha et al., 2020). Figure 1 depicts the manifestation of normal and pathological psychological activities (Klussman, Langer, & Nichols, 2021).

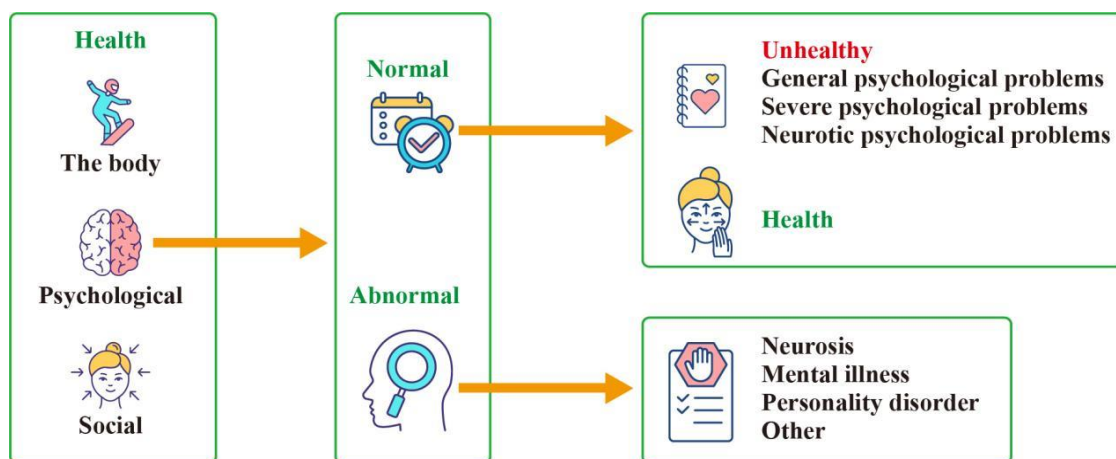


Figure. 1 Expression of normal and abnormal psychological activities

In the late 1940s, a survey of the health state of American college students revealed that roughly half of the college students failed at least one physical test indicator, which was

significantly lower than in other European nations. In recent years, the number of students' physical and mental health issues in American community mental health centers and

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hospitals, such as violence, drug abuse, and suicide, has skyrocketed in various schools, including violence, drug abuse, and suicide. Particularly, there are fewer admission restrictions in American public schools than in private schools, which allows children and adolescents with serious obstacles to entering schools, resulting in a growing number of potential crises that have attracted the attention of American society and academics (Zhu & Liu, 2020). The research of the Japanese scholar Fu indicates that once Japanese students enroll in college, their bedtime will be postponed till midnight. Many college students stay up late, resulting in a significant loss in their health. The results of a study on the health, exercise, diet, and rest of Japanese college students indicate that the majority of them have a common tendency toward decreased exercise time, an irregular diet, smoking, and drinking, as well as a steady decline in their physical and mental health levels (Zwingmann et al., 2021). Ishii, S., and others analyzed and studied the physical quality of university students and discovered that the overall level of physical quality of university students falls below the "Chinese students' physical health standard" (Ishii et al., 2020). Xu, H. conducted a follow-up survey on the physical health level of 2010 students in a business school four years later and found that in terms of body shape, the weight of boys tended to increase with the grade. However, their height stayed consistent without significant change (Xu, 2021). Girls' weight fluctuations are less pronounced than those of boys, and there is no substantial difference over four years of college. In terms of physical function, the vital capacity index of male and female students indicated a declining tendency, with no significant difference between first- and second-year students and a substantial difference between juniors and seniors. In terms of physical quality, the overall quality of men's and women's strength and endurance fell dramatically.

Kolenik, T. researched the current state of college students' mental health and concluded that there are objective mental health issues among Chinese college students. Complex ideas and personality traits lead to psychological contradictions. The inadequate campus environment and the unsatisfactory social reality exacerbate psychological pressure and loss; hence, it is unavoidable that contemporary college students have several mental health issues (Kolenik & Gams, 2021). Nam, T., and others administered the SCL-90 scale to college students, studied the impact of numerous factors on the mental health of Chinese college students, and showed that there are variances in the mental health levels of college students of different ages, genders, and majors (Nam & Kabutey, 2021). J. Laurie surveyed 1,761 college students from three colleges using stratified random sampling for a psychological study. The poll

results indicate that 50.6% of college students occasionally fail to concentrate on their studies, 43.7% of college students occasionally or frequently experience physical discomfort, and 43.5% occasionally or frequently experience psychological distress (Laurie et al., 2021). In "the effect of sports intervention on Strengthening Teenagers' physique and health," H Chen and colleagues argued that sports intervention could effectively enhance teenagers' physical qualities such as strength, speed, endurance, flexibility, and sensitivity, thereby achieving the goal of Strengthening Teenagers' physique and health promotion (Chen et al., 2021). In "Research on the Effects of Exercise Intervention on the Physical and Mental Health of College Students," by C. Lemon, it is demonstrated that exercise intervention can support the improvement of college students' BMI (Body Mass Index), vital capacity, and other physical attributes (Lemon et al., 2020). 30 Obese College Students from Hebei University of Economics and Trade participated in an 8-week exercise intervention experiment performed by X. Zhou. The trial results indicate that the one-hour, twice-weekly exercise intervention significantly impacts the body shape and function of obese college students and is of considerable assistance in improving the body shape and function of Obese College Students (Zhou et al., 2020). Ramirez Cifuentes, D., and others used 437 university students as experimental subjects. During 8 weeks of sports intervention, they conducted it twice weekly for 90 minutes every session. After 8 weeks of practice, the experimental group showed substantial weight changes, body fold thickness, flexibility, lower limb explosive power, cardiopulmonary function, and other indices, while the control group demonstrated no significant changes (Ramírez-Cifuentes et al., 2021). Li, J., and others used the experimental method to demonstrate that exercise can affect and improve various abnormal psychological states of students, cultivate students' brave and strong character, courage to overcome obstacles, and enterprising spirit. With the continuous progression of exercise behavior, students' character gradually develops from the inside out, resulting in a stable extrovert personality (Li, 2021).

In conclusion, there have been an increasing number of studies in recent years discussing the physical and mental health status of Chinese college students, with the majority of these articles focusing on the assessment of Chinese physical fitness test data and various physiological markers. Most studies on the mental health of college students employ questionnaire surveys. The questionnaires and scales utilized largely include the SCL-90 symptom self-assessment scale, college students' Personality Questionnaire (UPI), Personality

Questionnaire (EPQ), etc. (Taghvaei, Masoumi, & Keyvanpour, 2021). Most studies conducted outside China indicate that college students' health gradually declines. Some experts also investigated the factors affecting college students' health and proposed workable solutions and remedies. In addition, there are mental health issues among college students. College students are more prone to psychological stress due to the rapid pace of their studies and daily lives. University is a crucial time for a person's psychological growth. The transformation of concepts, the identification of roles, and many university-related problems will cause psychological maladjustment in college students and negatively impact their mental health (Zhao & Tang, 2021). Li Xiangchen, director of the intelligent sports innovation research center of the Institute of sports science of the General Administration of the sport of China, stated in the 328 sports model report that the 328 sports model proposes a new technical framework and implementation concept regarding sports behavior and habits. It is designed to promote the transformation of people's lifestyles and enhance their physical and mental health. Furthermore, this sports mode is not affected by time, location, or equipment and is more humanized and individualized.

Methodology

Research object

The experimental subject of this study is college students, and the research object is the effect of an exercise intervention on college students' physical and mental health.

Table 1

Statistical Table of distribution and recovery of College Students' basic information questionnaire (N=20)

Distribution object	Number of questionnaires issued	The number of questionnaires collected	Rate of recovery	Valid questionnaire	Efficient
Experience group	20	02	100%	20	100%
Control group	20	20	100%	20	100%

To ensure the reliability and scientific rigor of the questionnaire and scale results, the questionnaire was redistributed by random sampling to the subjects 15 days after the initial distribution. The results indicated that the questionnaire's test-retest reliability coefficient was $r = 0.92$, $P < 0.001$. The results indicated that the exercise effect and feeling questionnaire had a high level of reliability after the intervention, which could be used as the study's data statistics and theoretical foundation.

(2) SCL-90 symptom checklist

Students are given the SCL-90 psychological scale, primarily used to evaluate the mental health status of college students

Research methods

Literature method

When writing this paper, I have books on college students' physical and mental health, physical exercise, freehand sports, sports psychology, etc., from the Chinese library and the Beijing Sports University library. Simultaneously, I researched relevant literature on search engines such as CNKI and Wanfang database to understand the research state of pertinent themes, viewed videos about exercises of various items of 328 sports modes, and analyzed the essential materials. It provides a reference for developing physical and mental health evaluation indicators. It exercises intervention programs, as well as a solid theoretical and methodological foundation for the design of experimental programs and the composition of this document (Aria, B., 2021).

Questionnaire survey method

(1) Questionnaire on basic information of College Students

This paper gives some college students a "questionnaire on the basic information of college students," investigates the basic information of college students, grasps their age, gender, and other basic information, and uses the questionnaire to determine the daily life status of the experimental subjects and their comprehension of 328 sports modes. Understanding the sports items that college students enjoy most will be the foundation for selecting experimental sports intervention items. (See Table 1).

and collect data on students' psychological markers (Yang et al., 2020). To assure the correctness and reliability of the results, the associate professor of psychology research at Heze University distributed the two scales, and cautions were communicated beforehand. Face-to-face distribution and collection of recycled scales. (See Table 2).

In this study, Chinese psychologists selected and adapted the SCL-90 symptom checklist to apply to Chinese individuals. The SCL-90 scale is one of the most commonly used mental health assessment instruments in mental health research. According to the findings of previous researchers, the scale has a high degree of reliability and validity in the normal population and is

appropriate for individuals older than 16 years. The participants in this study are older than 16 years old.

This paper concludes that the SCL-90 scale has high reliability and validity.

Table 2

Statistics of distribution and recovery of SCL-90 scale (N=40)

Distribution object	Number of questionnaires issued	The number of questionnaires collected	Rate of recovery	Valid questionnaire	Efficient
Experience group	20	19	95%	19	95%
Control group	20	19	95%	19	95%

Results and Discussion

Using a method of expert evaluation, the validity of the questionnaire regarding the basic information of college

students was evaluated. A total of 10 experts were investigated and evaluated based on three criteria: the validity of the questionnaire's structure, its content, and its overall validity. Table 3 displays the particular evaluation results.

Table 3

Evaluation of expert validity(N=10)

Evaluation content	Very appropriate	Somewhat appropriate	Appropriate	Inappropriate	Very inappropriate
Construct validity	4	4	2	0	0
Content validity	3	5	1	1	0
Overall validity	1	6	2		0

Results and analysis of test indexes of the experimental group and the control group before the experiment

Before the formal start of the experiment, the physical health indicators, mental health, and other associated indicators of the experimental and control group college students were evaluated. After measuring physical health

indicators, the corresponding scores were converted using the "standard score table for the physical health test of Chinese college students" (see Appendix D). After each student's score was determined, it was translated to the group's overall score using a specific weighting ratio. The total score is the sum of the scores of all questions. The particular statistical results are presented in Table 4 below.

Table 4

Independent sample T-test of the psychological index in the experimental group and control group before the experiment(N=19)

Test index	The experimental group (M± SD)	Control group (M± SD)	T	P
Somatization	1.5±0.1	1.5±0.1	-0.4	0.7
Obsessive-compulsive symptoms	1.6±0.4	1.7±0.4	-0.1	0.9
Interpersonal sensitivity	1.7±0.2	1.7±0.3	0.1	0.9
Depressed	1.4±0.2	1.4±0.2	-0.3	0.8
Anxious	1.6±0.3	1.6±0.1	0.2	0.9
Hostile	1.5±0.3	1.5±0.3	-0.1	0.9
Terror	1.6±0.3	1.5±0.3	0.4	0.7
Paranoid	1.6±0.3	1.5±0.2	0.4	0.7
Psychotic	1.5±0.3	1.5±0.3	-0.3	0.8
Others (diet, sleep, etc.)	1.4±0.3	1.5±0.3	-0.1	0.9
The total score of the psychological index	137.1±10.9	137.4±9.0	-0.3	0.8

The independent sample t-test was conducted using the Spss17.0 software on the individual index data of physical and mental health and the total physical and mental health scores of the experimental subjects acquired before the experiment. The P values of the overall score of the physical and mental test indices for the experimental and control groups were 0.85 and 0.76, respectively, both beyond 0.05. It demonstrates no statistical difference in the

total physical and mental health scores between the two groups of students before the experiment. Still, the p-value of each single index is greater than 0.05. Each index of the data of the two groups conforms to the normal distribution, which demonstrates that there is no statistical difference between the 17 single indexes of physical and mental health between the two groups of students, indicating that the level of equivalence is not significant.

Analysis of the changes in physical health indexes in the experimental group and the control group before and after the experiment

After a 12-week experimental intervention, the experimental subjects were tested, the scores of the experimental group and the control group were compared using an independent

sample t-test, and the scores of the two groups of students in the experimental group and the control group were compared using a paired sample t-test before and after the experiment, to assess the impact of the exercise intervention on the physical health indicators of college students. Refer to Tables 5, 6, and 7 for precise statistical results.

Table 5

T-test of independent samples of physical health indicators in the experimental group and the control group after the experiment (N=19)

Test index	The experimental group (M± SD)	Control group (M± SD)	T	P
BMI	93.7±11.7	92.36±12.0	0.3	0.8
Vital capacity	79.90±11.8	92.3±13.7	-0.6	0.6
Pull up (male)	53.4±30.3	51.4±25.9	0.2	0.8
Sit-ups (female)				
50m run	76.8±5.4	75.2±5.7	0.9	0.4
Standing long jump	78.8±12.9	73.9±11.3	1.2	0.02**
Sitting body flexion	76.3±12.6	76.7±7.2	-0.1	0.9
1000m (male)	77.0±12.3	69.1±11.2	2.1	0.04**
800m (female)				
The total score of physical indicators	70.0±8.4	68.4±5.8	0.7	0.5

**Indicates significant difference

***Indicates an extremely significant difference

Table 6

T-test of paired samples before and after the experiment (N=19)

Test index	The experimental group (M± SD)	Control group (M± SD)	T	P
BMI	92.4±12.0	93.7±11.7	-1.0	0.3
Vital capacity	78.6±11.4	79.9±11.8	-2.1	0.05**
Pull up (male)	47.6±32.1	53.4±30.3	-2.2	0.04**
Sit-ups (female)				
50m run	76.0±4.9	76.8±5.4	-2.2	0.03**
Standing long jump	77.5±11.7	78.8±12.9	-2.2	0.04**
Sitting body flexion	75.6±13.7	76.3±12.6	-1.0	0.3
1000m (male)	75.2±12.9	77.0±12.3	-2.2	0.04**
800m (female)				
Weighted score	68.5±8.5	70.0±58.4	-3.5	0.00**

Table 7

T-test of paired samples before and after the experiment of physical health indicators in the control group (N=19)

Test index	The experimental group (M± SD)	Control group (M± SD)	T	P
BMI	93.7±11.7	92.36±12.0	1.0	0.3
Vital capacity	82.7±13.5	92.3±13.7	0.5	0.7
Pull up (male)	47.7±26.3	51.4±25.9	-1.6	0.1
Sit-ups (female)				
50m run	75.4±6.6	75.2±5.7	0.4	0.7
Standing long jump	72.8±10.7	73.9±11.3	-1.9	0.1
Sitting body flexion	75.1±11.5	76.7±7.2	-0.9	0.4
1000m (male)	69.2±11.8	69.1±11.2	-0.2	0.9
800m (female)				
Weighted score	68.0±5.9	68.4±5.8	-1.4	0.2

Following the study, an independent sample t-test was conducted on the physical health index data of the subjects. In both the test and control groups, the p-values for the two single jumps of the 1000-meter run for boys and the 800-meter run for girls were less than 0.05, and all other indicators were larger than 2. A p-value greater than 0.05 for each body measurement's weighted total score was insignificant.

Analysis reveals statistically significant differences in the standing long jump index across the experimental group. As a result of unarmed squatting, standing heel lifting, and alternating lunge and arrow jumps, the strength and explosive power of the students' lower limbs are increased, which is the primary cause of the performance improvement. The experimental group significantly outperforms the control group on the 1000m / 800m running index. Students' cardiopulmonary function and muscular endurance are effectively increased with 12 weeks of flat plate support, in-situ high leg lifts, and other activities. To gain a deeper understanding of the effect of exercise intervention based on 328 exercise modes on the physical health indicators of students in the experimental group, a paired sample t-test was performed on the physical health indicators of students in the experimental group and the control group before and after the experiment, i.e., to determine whether there was a significant difference between the two groups. From [Tables 6 and 7](#), it can be determined that the p-value of students in the experimental group for vital capacity, pull-ups/sit-ups, 50m running, standing long jump, 1000m running, and other indicators are less than 0.05, with a significant difference, indicating that these indicators have improved after the experiment compared to those before the experiment, and the improvement effect is significant. However, there were no statistically significant differences in BMI, sitting posture, or forward flexion ($P > 0.05$). The p-value of the total score is less than 0.01, and the difference is highly significant, showing that the markers of physical health of the experimental group's pupils after 12 weeks of practice are significantly higher than those before the experiment. The P values of individual physical indices and weighted total scores of students in the control group were greater than 0.05, which was not statistically significant, indicating that there was no significant change in the physical health level of students in the control group between the beginning and end of the experiment.

According to the prescribed sports intervention plan, students in the experimental group have enhanced their physical traits, such as strength, endurance, and speed, through three months of training. Before and after the experiment, there were also substantial

variations in the vital capacity index of the experimental group. The vital capacity index primarily represents the cardiopulmonary function of students. The level of physical function of college students can be improved to a certain extent through physical exercise. The level of vital capacity, which is affected by many factors such as age, gender, physique, respiratory muscle strength, and lung and chest elasticity, can be increased to a certain extent through physical exercise. Although numerous studies have demonstrated that some exercise interventions can increase the BMI of college students, there is no significant change in the BMI of the experimental group before and after the trial. Because most university students are beyond 18, their body shape development is complete, and their height will not alter much. The body weight of most pupils will not vary much in a short period, except for a few students with excessive weight. Therefore, this index does not differ significantly. The P values of all indices in the control group were greater than 0.05, indicating no significant differences between various indexes before and after the trial and that the level of physical health did not increase considerably.

In this study, the outcome is better the higher the score of each measure used to evaluate the level of physical fitness after conversion. The bigger the increase between before and after the experiment, the greater the improvement in physical health. This study examines the mean difference of each physical health index. The weighted total score of the two groups of students before and after the experiment calculates the mean difference (mean difference = post-experiment performance - pre-experiment performance) and formulates the histogram of the increase and decrease range of each index to more visually illustrate the differences of each index. See [Figures 2 and 3](#) for precise statistical information.

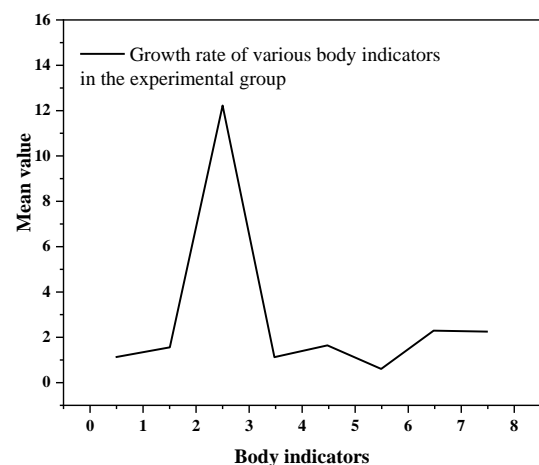


Figure 2 Growth range of physical indexes in the experimental group before and after the experiment

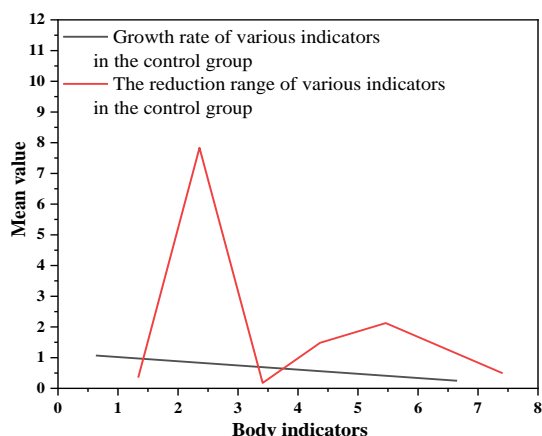


Figure. 3 Increase/decrease the range of physical indexes of students in the control group before and after the experiment

The growth range of six indices, including BMI, vital capacity, pull-ups/sit-ups, 50m running, standing long jump, and 1000m/800m running, as well as the weighted total score of students in the experimental group are greater than those in the control group, as shown by the analysis of the figure above. The index of pull-ups/sit-ups has the greatest degree of growth, and the average score for a single item has increased by 5.84 points, a 12.27% increase compared to before the trial, which is much more than the control group. The primary reason is that the 12-week experimental intervention promoted the growth of the experimental group's students' strength quality. Compared to before the experiment, the average score of the experimental group increased by 1.47 points or 2.15 percent. In comparison, the weighted total score of the control group climbed by 0.38 points, or 0.56%, which is significantly lower than that of the experimental group. In contrast, despite the experimental control measures performed by the control group, in addition to the 800m/1000m run and the decrease in BMI, other indicators have grown. Among the sitting forward flexion index scores, the control group's average value after the experiment increased by 1.58 points compared to that before the experiment, an increase of 2.1% before the experiment, which is greater than the growth range of the experimental group. In contrast, the growth range of other indicators is considerably less than that of the experimental group. Based on the above analysis, the experimental group has significantly improved all indicators of physical health through the three-month exercise, with the index score of pull-ups/sit-ups increasing the most and the total score of physical health in the experimental group also increasing to a certain extent, indicating that the physical health level of students in the experimental group has been significantly improved before and after the experiment. The control group pupils did not engage in the activity. In

addition to the decrease in some index scores, other indexes also improved. Still, the range of improvement was very different from that in the experimental group. The total score was not significantly different from that before the experiment, indicating that the physical health level of the students in the control group did not change significantly between before and after the experiment.

Analysis of the changes in mental health indexes in the experimental group and the control group before and after the experiment

This paper uses low and excellent indicators to evaluate physical and mental health. The greater the student's mental health level, the lower the score obtained after conversion. The improvement in physical health is proportional to the reduction in each index score before and after the experiment. To further illustrate the differences in physical and mental health indicators between the experimental and control groups before and after the experiment, this paper statistically organizes the mean difference between the two groups of students' scores before the experiment. According to the improved range of various indicators, a histogram is constructed to more intuitively illustrate the differences between the two groups before and after the experiment. The specific statistical outcomes are presented in Table 8.

Table 8

Difference between the mean value of psychological indexes before and after the experiment between the experimental group and the control group (mean value after the experiment - mean value before the experiment)

Test index	Experience group	Control group
Somatization	-0.05	-0.05
Obsessive-compulsive symptoms	0.02	0
Interpersonal sensitivity	-0.06	0
Depressed	-0.02	0
Anxious	-0.12	0.01
Hostile	-0.12	-0.01
Terror	-0.05	-0.01
Paranoid	-0.07	0.07
Psychotic	-0.04	0
Others (diet, sleep, etc.)	-0.06	0.01
Total score	-4.37	-0.05

Table 8 displays the difference between the mean value before and after the experiment: the experimental group's scores on the nine single indexes of somatization, obsessive-compulsive symptoms, sadness, anxiety, and hostility have dropped, as has the overall score. Hostility has the most noticeable effect on the index, and its effect is

much more pronounced on the three indices of OCD symptoms, despair and fear. Additionally, the total score reduced drastically by 4.37 points. The control group only had a considerable decrease in the somatization score, a little decrease in hostility and fear, no change or rise in the scores of other indicators before the trial, and a decrease of 0.05 in the total score.

The discrepancies between the two groups were investigated to determine their causes. Through 12 weeks of exercise intervention, the experimental group improved their mental health, relieving stress, and decreased their hostility score. In addition, pupils will get more energized by practicing particular sports and lessen their somatization index score. In practice, students will engage in particular forms of communication. Numerous students take the initiative to speak with others, which will diminish their interpersonal sensitivity score to some degree. Obsessive-compulsive symptoms are characterized by the coexistence of conscious compulsion and anti-compulsion and the repeated invasion of the mind by meaningless ideas or urge against one's will. The decreased range of each index score in the control group was much smaller than in the experimental group. There was an increasing trend in anxiety, paranoia, and the other three components, with the increase range of paranoia reaching 4.58%. Most students in the control group frequently use mobile phones and other electronic devices, which is the primary cause for this result. They rarely exercise, have little touch with classmates, and cannot

handle stress. Therefore, they are susceptible to sentiments of doubt, envy, etc., which are paranoia's hallmarks.

Conclusion

According to the above analysis, a three-month exercise program based on the exercise intervention scheme established by 328 exercise mode can effectively improve college students' mental health. The scores of the majority of indicators have been reduced. Still, the index of obsessive-compulsive symptoms cannot be reduced, while the anxiety and hostility indicators play the most prominent role. The total score of the mental health level and the scores of every single index of the students in the control group have not changed significantly since before the experiment. Still, there is little difference between the index of somatization and the experimental group, and the score of paranoia has significantly increased. Experiments in kinematics demonstrate that regular and appropriate physical exercise is crucial in preventing mental illness and relieving mental stress. Many individuals engage in physical activity to improve their mental health, but the exercise effect varies depending on the intensity, duration, and frequency of physical activity. Both high and low-intensity physical exercise can improve mental health to some degree, but the moderate intensity is optimal. Therefore, the school sports program should develop a reasonable lesson plan and curriculum and reasonably arrange the physical education class's exercise intensity.

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