The application and effect analysis of physical training in college students' physical improvement

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Abstract. Objective: To explore the application and effect of physical training in college students' physical fitness improvement. **Methods:** The impact of physical fitness training and traditional physical education on the physical health of college students was analyzed by comparison. The experiment used the process of a randomized controlled trial; 30 college students were selected as the research subjects, divided into physical fitness training groups and control groups, and continued training for 18 weeks. Before and after the training, the athletes underwent a comprehensive physical fitness test and physiological and biochemical indexes. **Results:** P values for 1000 meters before and after the experiment for both boys were 0.009, P<0.01; pull-ups P value was 0.001, P<0.01; lung capacity P value was 0.037, P<0.05; 50 meters P value was 0.024, P<0.05. P values for 800 meters before and after the experiment for girls were 0.041, P<0.05; 1-minute sit-up P-value was 0.001, P< 0.01; standing long jump P-value was 0.001, P<0.01; seated forward bending P-value was 0.027, P<0.05. Before and after the experiment for boys and girls, RBC P-value was 0.012, P<0.01; HGB P-value was 0.01, P<0.01; MCV P-value was 0.03, P<0.05; MCHC P-value was 0.02, P<0.05. MCH P value was 0.05, P<0.05. **Conclusion:** Physical training can effectively improve college students' sports performance ability and physical health.

Keywords: Physical training; college students; physical improvement.

1 Introduction

In today's society, the physical health of college students is of broad concern[1]. In recent years, with the change in lifestyle and the increase in learning pressure, the physical health level of college students has shown a significant downward trend[2, 3]. This trend is not only related to students' physical health but also directly affects their learning efficiency, psychological state[4, 5], and quality of life[6, 7]. The survey shows that due to sedentary[8], irregular diet, lack of exercise, and other factors, most college students are overweight or obese, physical decline, lack of Endurance, and other issues[9].

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Moderate physical activity enhances physical health[10]. It helps improve learning efficiency, enhances disease resistance[11], and positively impacts mental health.

The development of physical training as a systematic training method in the 20th century, especially with the development of sports science and a deeper understanding of human movement. In recent years, physical training has expanded from the training of professional athletes to the general public. It has become the key to improving physical and mental health and quality of life. Physical training enhances various physical abilities, not limited to a single aspect. Physical training can be personalized according to the individual's physique, goals, and needs. Training emphasizes functional movement, that is, those movements that can find direct application in daily life or specific movements. Combine different types of training, such as aerobic exercise, strength training, and flexibility training.

The study found that regular physical training significantly improved participants' physical health indicators[12], especially regarding cardiorespiratory Endurance and muscle strength. In addition, participants also showed positive effects on mental health[13], such as reducing stress and improving overall mood[14]. Physical training promotes better living habits, such as improved diet and sleep quality[15].

This study explores the impact of physical training on college students' physical health. Practical physical exercise can help college students improve their physical fitness, improve their quality of life, and lay a solid foundation for their future careers. In general, this study is of great significance to improving the physical health of college students and also provides relevant references for improving physical training methods.

2 Research Objects and Methods

2.1 Subjects of Study

(1) To study the influence of physical training intervention on college students' physical health, 30 students from Guangdong University of Science and Technology were selected as the experimental subjects. Table 1 shows the basic information of the experimental subjects.

(2) Experimental subjects screening:

a. Students of Guangdong University of Science and Technology (Guangdong University of Science and Technology, all grades of physical education class time is unified, so to ensure that the time of physical education testing is consistent, physical education class time is consistent).

b. Physical health without contraindications to exercise, no genetic or congenital diseases. Through the annual routine, student electrocardiogram (ECG) during the student's physical examination to rule out risk factors such as cardiovascular disorders.

c. I have taken the Physical Fitness Test for College Students, and my scores are valid.

d. Fill out the Physical Activity Rating Scale (PARS-03) in Appendix 1.

e. There should be little difference in the sleeping, eating, and living habits of the subjects.

Table 1. Basic information of the subjects ($\overline{X}$ ±SD)

Index	Control group(N=15)	Experimental group(N=15)
Age (years)	23.66±1.79	22.20±2.33
Height(cm)	169.12±6.12	169.12±5.90
Weight(kg)	57.40±7.50	58.12±9.11
Gender (male/female)	10/5	10/5

2.2 Research Methods

2.2.1 Documentation Law

According to the needs of this study, consult relevant professional books to understand the appropriate knowledge of physical exercise intervention. At the same time, in electronic databases such as China National Knowledge Infrastructure, Elsevier, Web of Science, Springe, and PubMed, 'College Students' physical health,' 'Physical Fitness Training Intervention,' 'physical health of college students,' 'Exercise intervention,' etc. were searched for related literature—in-depth understanding of the impact of physical training intervention on college students' physical health. Organize and analyze the literature, combined with the actual needs of this study, to learn and reference. The analysis and understanding of relevant literature provide the theoretical basis and help for the Research of this paper.

2.2.2 Experimental Method

2.2.2.1 Experimental time and place

The experiment lasted 18 weeks, from March 16, 2023, to July 30, 2023.

Guangdong University of Science and Technology.

2.2.2.2 Screening of experimental subjects

a. Physical health: No exercise contraindications or genetic or congenital diseases. And through the annual routine student physical examination in the electrocardiogram examination, excluding cardiovascular disorders and other risk factors.

b. The physical health test of college students has been carried out, and the results are compelling.

2.2.2.3 Arrangement of experimental content

The overall idea of the experimental design is that four physical training contents were designed, taking every 2 class hours as a cycle, a total of 18 weeks, 36 class hours (see Table 2). Control group training content (see Table 3). The heart rate index of physical training is 140 times/min, and the interval time is set to 1 minute.

The following training effect will ensure solid continuity to achieve the best results.

Table 2. Physical training experiment content class hour arrangement

	Lesson 9 / 10 Time	Lesson 9 / 10 Time	Lesson 9 / 10 Time	Lesson 9 / 10 Time
Content	30S Limit Run	Continuous vertical	Enhanced push-ups	Supine throwing a
Duration	30S	Jump	30s	medicine ball
Intensity	Heart rate 140	20S	Heart rate 140	30s
	beats/min.	Heart rate 140	beats/min.	Heart rate 140
Quench time	1min	beats/min.	5min	beats/min.
Intermittent	0, Jogging	5min	0, Walk	5min
strength		0, Walk	10	0, Walk
Times	5	5	3	10
Groups	3	3	5min	3
Interblock space	5 min	5min		5min
Development quality goal	Speed; Endurance	Explosive force; Coordination energy Force	Upper limb muscle strength; Explosive force; Balance ability	Muscle strength of abdomen and upper limbs; Explosive force

Table 3. Training contents of the control group

	Content of courses
1.Jump	1.Standing long jump
	2.High jump
	3.Single leg jump
	4.Striding jump
2.Run	1.Squat start
	2.30 meters acceleration run
	3.Shift running
	4. Endurance running
3.Throw	1.Baseball throw
	2. Solid ball throw
4.Game and Test	1.Fishing
	2.Pasted biscuits
	3.Fitness test

2.2.2.4 Experimental Test Indicators

The indicators are selected based on the indicators chosen by the 'National Student Physical Health Standard' (see Table 4). Each subject had a pulse blood sample taken

from the hospital before and after the course, and the relevant physiological and biochemical parameters were examined. See Table 5.

Table 4. Physical health test indicators

Selected physical health indicators	
Boys	Girls
Vital capacity	Vital capacity
50m run	50m run
Standing long jump	Standing long jump
Pull-up	One minute sit-ups
1000m	800m
Sitting forward flexion	Sitting forward flexion

Table 5. Physiological and biochemical indicators

Physiological Indicators (M/F)	Unit
Red Blood Cells (RBC)	10^{12}/L
Hemoglobin (HGB)	g/L
The mean volume of erythrocytes (MCV)	fl
Mean red blood cell HGB concentration (MCHC)	g/L
Mean hemoglobin of red blood cells (MCH)	pg

(1) 50m running test method: select the linear distance of 50m, and students take the standing starting posture with the fastest speed to run the whole process of the time used as a test result.

(2) 1000m (male) / 800m (female) test method: 800m / 1000m is selected as the endurance quality test site in the track and field field. Students must wear sportswear and sneakers to participate in the test, and the time spent running the whole course is taken as the test result.

(3) The standing long jump test method is used from the standing position of the long jump, with the mark line as the standard, with both feet forward jump, measuring the vertical distance between the heel and the mark line as a test result.

(4) One-minute sit-up test method: The subjects were supine on the pad, their legs were slightly separated, the knees were bent at 90 degrees, and the two fingers were crossed and pasted behind the brain. The other companion fixed its ankle joint to fix the lower limb. When the subjects sat up, two elbows touched or exceeded both knees to complete once. Shoulder pads must be felt when lying on your back. When the tester issues the 'start' password, the timer is opened, and the number of completions within 1 minute is recorded.

(5) Pull-up test method: The subject's hands are holding the bar, and both hands are overhanging with shoulder width. After resting, the two arms pull the body (the body can not have additional action) at the same time and pull up to the lower jaw more than the upper edge of the horizontal bar.

Complete once. Record the number of pull-ins.

(6) Sit and reach test method: sit on the mat, legs together, the knee to keep a straight state, toe up, the foot pedal in the tester pedal surface, hands as straight as possible,

hold the tester's sign rod, try to slowly push forward the marker, the location of the marker shows the distance recorded as test results.

2.2.2.5 Preparation of experimental equipment

One lung capacity test instrument, one-meter ruler, one stopwatch, one sitting body flexion test instrument, and one standing long jump test instrument.

2.2.2.6 Mathematical statistics

EXCEL statistically analyzed the experimental results, and the student's physical health tests were analyzed using SPSS 24. O software to test whether there were significant differences in the experimental intervention group.

3 Experimental Results and Analysis

3.1 Comparative Analysis of the Physical Health of Students in the Physical Training Intervention Group Before and after the Experiment

3.1.1 Comparative Analysis of the Physical Health of Boys in the Physical Training Intervention Group Before and After the Experiment

It can be seen from Table 6 and Figure 1 that the 1000 meters of the boys in the physical training intervention group before the experiment was 219±46.1s, and the pull-up was 11.7±5.7 times. After the experiment, the 1000 meters was 199±46.9s, and the pull-up was 15.3±5.9. Before and after the experiment, the paired sample T-test showed that the P value of 1000 meters was 0.009, $P < 0.01$; the pull-up P value was 0.001, $P < 0.01$. It shows significant differences in 1000 meters, pull-up, 50 meters, and sit-and-reach of boys in the physical training intervention group before and after the experiment. Therefore, physical training can effectively improve the ability to perform sports and the physical health level of male college students.

Table 6. Comparative analysis of physical fitness of male physical training intervention group before and after the experiment

Index	Pre-experiment	After the experiment	T	P
Vital capacity(ml)	4456±828.6	4560 ±674.3	0.546	0.594
50m(s)	7.05 ±0.49	6.90 ±0.46	2.07	0.059*
1000m(s)	219 ±46.1	199± 46.9	3.067	0.009**
Pull-up (times)	11.7±5.7	15.3±5.9	4.539	0.001**
Standing long jump(cm)	241± 24.4	241±20.6	0.055	0.957
Sitting body forward bending(cm)	15.17 ±3.38	17.75±5.24	2.132	0.053*

Note: * $P < 0.05$, ** $P < 0.01$, T value is absolute.

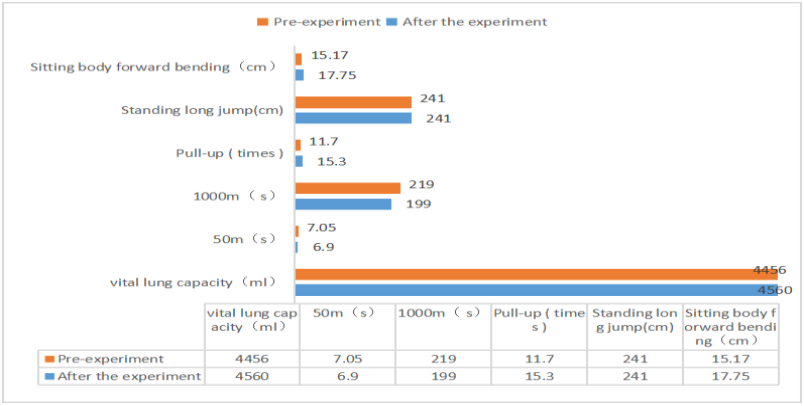

Fig. 1. Comparative analysis of physical fitness of male physical training intervention group before and after the experiment

3.1.2 Comparative Analysis of the Physical Health of Girls in the Physical Training Intervention Group Before and After the Experiment

It can be seen from Table 7 and Figure 2 that the vital capacity of girls in the physical training intervention group before the experiment was 2858±154.8ml, 50 meters was 8.45±0.75 s, 800 meters was 239±36.4 s, one-minute sit-up was 41.5± 6.80 times, standing long jump was 180±16.09 cm, and sit-and-reach was 11.26± 5.69 cm. After the experiment, the vital capacity was 3274 ± 366.1ml, 50 meters was 7.96±0.68s, 800 meters was 217±37.9s, one-minute sit-ups was 51.6±8.8 times, standing long jump was 191±14.4cm, sit-and-reach was 12.29±6.38cm. Before and after the experiment, the paired sample T-test showed that the vital capacity P value was 0.037, $P < 0.05$, the 50-meter P value was 0.024, $P < 0.05$, the 800-meter P value was 0.041, $P < 0.05$, the one-minute sit-up P value was 0.001, $P < 0.01$, the standing long jump P value was 0.001, $P < 0.01$, and the sit-and-reach P value was 0.027, $P < 0.05$.

It shows significant differences in vital capacity, 50 meters, 800 meters, one-minute sit-ups, standing long jump, and sit-and-reach before and after the experiment in the physical training intervention group. Therefore, physical training can effectively improve the ability to perform sports and the physical health level of female college students.

Table 7. Comparative analysis of the physical fitness of the girls' physical training intervention group before and after the experiment

Index	Pre-experiment	After the experiment	T	P
Vital capacity(ml)	2858±154.8	3274 ±366.1	2.823	0.037*
50m(s)	8.45 ±0.75	7.96 ±0.68	3.191	0.024*
800m(s)	239± 36.4	217 ±37.9	2.726	0.041*
One minute sit-ups (times)	41.5 ±6.80	51.6± 8.8	7.386	0.001**
Standing long jump(cm)	180± 16.09	191 ± 14.4	7.854	0.001**
Sitting body forward bending(cm)	11.26 ±5.69	12.29 ±6.38	3.098	0.027*

Note: * $P < 0.05$, ** $P < 0.01$, T value is absolute.

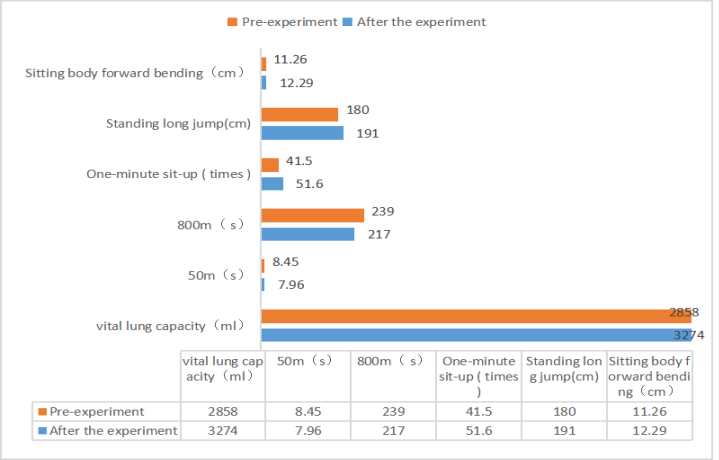

Fig. 2. Comparative analysis of physical fitness of female physical training intervention group before and after the experiment

3.1.3 Comparative Analysis of Physiological and Biochemical Indices of Men And Women in the Physical Training Intervention Group Before and After the Experiment

As can be seen in Table 8 and Fig. 3, the RBC of male and female students in the pre-experimental physical training intervention group was 4.22±0.47 10^{12}/L, the HGB was 126.13±11.24 g/L, the MCV was 84.74±3.19 fl, the MCHC was 325.46±13.04 g/L, and the MCH was 26.75± 1.66 pg. Post-experimental RBC was 4.77±0.50 10^{12}/L, HGB was 142.80±16.08 g/L, MCV was 86.53±3.61 fl, MCHC was 333.46±13.06 g/L, and MCH was 28.04±2.48 pg. Pre- and post-experimental comparisons yielded a P value of 0.012 for RBC after paired-sample t-test, P<0.01, HGB P-value was 0.01, p<0.01, MCV P-value was 0.03, p<0.05, MCHC P-value was 0.02, p<0.05 and MCH P-value was 0.05, p<0.05.

It indicates that there is a highly significant difference between the physical training intervention group in terms of RBC, HGB, MCV, MCHC, and MCH in men and women before and after the experiment. Therefore, physical fitness training can effectively improve the physical health of male and female college students.

Table 8. Comparative analysis of physiological and biochemical indexes of boys and girls in the physical training intervention group before and after the experiment

Index		Pre-experiment	After the experiment	T	P
Red Blood Cells(RBC)	10^{12}/L	4.22±0.47	4.77±0.50	2.87	0.012**
Hemoglobin (HGB)	g/L	126.13±11.24	142.80±16.08	2.98	0.01**
The mean volume of erythrocytes (MCV)	fl	84.74±3.19	86.53±3.61	2.41	0.03*
Mean red blood cell HGB concentration(MCHC)	g/L	325.46±13.04	333.46±13.06	2.60	0.02*
Mean hemoglobin of red blood cells (MCH)	pg	26.75±1.66	28.04±2.48	2.14	0.05*

Note : * P < 0.05, ** P < 0.01, T value is absolute.

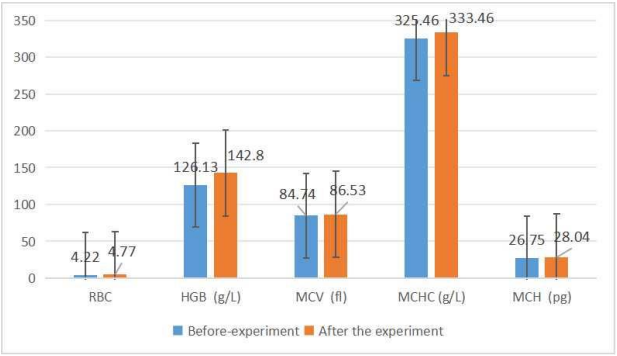

Fig. 3. Comparative analysis of physiological and biochemical indexes of boys and girls in the physical training intervention group before and after the experiment

4 Discussion

With the development of the times, there is more and more Research on physical training in today's society. Physical training injects fresh blood into sports training, improves people's physical health level and sports ability, and improves the attention of all sectors of society to physical exercise [16].

Strength training in physical training builds muscle strength and improves explosive power and Endurance [17, 18]. This is important for college students when they participate in various sports and activities, enabling them to perform better in competitions or workouts. Through physical training, college students can engage in targeted speed training and agility training to improve running speed, reaction time, and body agility[19]. This is critical for participation in sports that require quick reactions and movements, such as basketball and soccer[20]. Physical training can also help college students improve their coordination and balance and enhance their body control[21]. This is very important for performing sports programs that require balance and coordination, such as roller skating and rock climbing. Proper physical training can help college students master sports skills and techniques and improve their performance levels in specific sports. Good physical training can help college students prevent sports injuries[22] while speeding up rehabilitation [23]. Improving muscle strength and flexibility[24] reduces the risk of joint injuries and protects physical health. In summary, physical training significantly impacts college students' athletic ability [25], which can increase strength and Endurance, improve speed and agility, enhance coordination and balance, and improve technique and skill levels while preventing sports injuries. Therefore, college students should take physical fitness training as an essential way to enhance athletic ability and incorporate it into their daily training.

Physical training can help college students release stress and anxiety. Exercise releases adrenaline and endorphins in the body and promotes the balance of neurotransmitters in the brain, thus improving the emotional state[26, 27]. During exercise, college students can focus on physical movement, therefore temporarily leaving behind

the worries of school or life and obtaining relaxation and relief. Through physical training, college students feel that their bodies become more robust and more flexible, improving their physical fitness level[28, 29], thus enhancing their self-esteem and self-confidence. This positive physical feeling can be transformed into confidence in one's abilities, helping to alleviate self-doubt and negative emotions. College students often face academic pressure and life chores and are prone to sleep problems. Appropriate physical training can help regulate the biological clock, promote deep sleep, and improve sleep quality. Adequate sleep is crucial to the mental health of college students, which can improve concentration and learning efficiency and alleviate anxiety and depression. In conclusion, physical training has a positive impact on the mental health of college students, which can help them release stress[30, 31], enhance self-esteem and self-confidence, improve sleep quality[32], and promote socialization and teamwork. Therefore, college students should incorporate physical fitness training into their daily lives and regard it as one of the important means to maintain their mental health[10, 33].

Physical training is a complex and delicate system of engineering. With the advent of big data and artificial intelligence, physical training will integrate high technology and develop into a new discipline[34]. Therefore, the Research on physical training should pay more attention to in-depth scientific Research and practical exploration from multiple dimensions and fields.

Physical training on the change of orientation ability, and they pointed out that the ability to change direction quickly (COD) is a critical skill in many pitches and field sports. The COD test was performed before and after the training intervention, and the length of the test and the number of changes in a specific angle direction were described in detail and compared with traditional resistance training, Olympic weightlifting, and children's strength training provided similar or more significant improvements in performance. Sixty-three children (10-12 years old) were randomly assigned to the experiment. It was found that Olympic weightlifting was superior to traditional training in improving CMJ, horizontal long jump, 5-meter and 20-meter sprints. Michael Boyle et al. believe that physical exercise function training pays special attention to the development of core strength, improves the athlete's athletic ability by enhancing core strength stability, and emphasizes multi-dimensional and multi-plane comprehensive training[35].

The American youth physical fitness test was initially established, and the youth physical fitness test standard was officially released in 1958. In 1988, the E.U. countries held a conference on adolescent physical fitness tests and developed a unified European countries "EUROFIT" physical fitness test standards. In the 1970s and 1980s, it developed into a physical fitness test system that focused on the healthy development of young people and reduced the risk of disease. It introduced national program planning and implemented a health monitoring system, which further strengthened the physical fitness test of young people and promoted the effective development of physical fitness test of young people and the development of active lifestyle and healthy lifestyle behavior of young people[36].

College years are a critical period when lifelong behaviors are formed and may have an impact on the development of chronic conditions later in life[37]. Given the existing

gaps and the limited knowledge of sedentary behaviors and physiological health determinants among young adults, exploring these topics and having a better understanding seem to be the key to developing primary prevention strategies.

Limitations and difficulties of this study:

Sample representativeness: Sample selection may need to be more thorough to represent all college students living habits and physical differences, especially students from different regions and backgrounds.

Difficulties with long-term follow-up: Long-term follow-up of participants' health status and physical fitness changes may need help regarding resources and participants' continued engagement.

The complexity of control variables: It is a complex problem to control variables related to the effect of physical training (such as diet, sleep, living habits, etc.).

Individual differences: There are differences in the response of individuals to physical training, which may affect the universality of the results.

Subjective assessment bias: Subjective assessment of health and physical improvement may be affected by prejudice or misunderstanding.

5 Conclusions

Physical training can effectively improve college students' sports performance ability and physical health.

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Appendix 1

Physical Activity Rating Scale

This questionnaire measures your average weekly participation in physical activity over the past month. Please tick the box that best describes your situation.

1. What is the intensity of your physical activity?

① Light exercise (e.g., walking, doing radio exercises, playing gateball, etc.).

② Small-intensity less intense sports (such as recreational volleyball, bingo, jogging, taijiquan, etc.).

③ Medium-intensity, more intense, and long-lasting exercise (e.g., bicycling, running, table tennis, etc.).

④ High-intensity but not long-lasting exercise that involves shortness of breath and sweating (e.g., badminton, basketball, soccer, etc.).

⑤ High-intensity, long-lasting exercise that involves a lot of sweating and shortness of breath (e.g., running, aerobics, swimming, etc.).

2. How many minutes at a time do you perform physical activities of the above intensity?

① Less than 10 minutes
②10 to 20 minutes
③ 21 to 30 minutes
④31 to 59 minutes
⑤More than 60 minutes

3. How often do you engage in physical activity of the above intensity?

① Less than once a month
② 2 to 3 times a month
③ 1 to 2 times a week
④ 3 to 5 times a week
⑤Approximately every day

Instructions:

The physical activity level scale (PARS-3) revised by Liang Deqing et al. was used to test the physical activity level. The scale examines the amount of physical activity from three aspects: intensity, time, and frequency of physical activity. Exercise amount = intensity × time × frequency, intensity, and frequency from 1 to 5 grades, respectively, 1-5 points, time from 1 to 5 grades, respectively, 0-4 points, the highest score is 100 points, the lowest score is 0 points, and the criteria for evaluating the exercise amount: ≤ 19 points for fluctuating amount, 20-42 points for moderate exercise amount, and ≥ 43 points for heavy exercise amount. The reliability of PARS-3 was 0.82.

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