



Developing an Exercise Program to Improve Physical Fitness and Mental Health among University Students in Xi'an

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Abstract

Background and Aim: A university education is an important time to promote the healthy development of teenagers. It also plays a crucial role in cultivating exercise habits among undergraduate students. However, in the field of exercise, we have observed a downward trend in proactive engagement, where students do not have access to exercise programs. This study aimed to foster the healthy growth of undergraduates by improving their physical fitness and reducing anxiety through a well-designed exercise program. Therefore, the main objective of the research was the development of an exercise program to improve health-related physical fitness and reduce anxiety for students at Xi'an Physical Education University.

Materials and Methods: The research methods included a literature review on the physical fitness of 1000 students with low physical fitness and high anxiety at Xi'an Physical Education University. Researchers surveyed the anxiety levels of forty-five university students with high anxiety using a specified sampling method. The results of the physical fitness test and anxiety were obtained through a semi-structured questionnaire and the draft exercise program was developed based on experts' deep interviews. Subsequently, researchers implemented an experimental exercise program. Finally, the exercise program was confirmed through a survey.

Result: The research results were obtained after conducting in-depth interviews with experts. Subsequently, researchers carefully designed and evaluated an exercise program using the IOC's scoring criteria. This exercise program was then implemented in an eight-week experiment. After the students engaged in this exercise program for eight weeks, the results of all physical fitness test items reached the passing level. Additionally, thirty-one students no longer felt anxious, and the number of students experiencing mild anxiety dropped to fourteen.

Conclusion: There are many students whose physical fitness scores are unsatisfactory, unqualified, and who experience anxiety. After eight weeks of physical exercise, the anxiety scores of 31 students were within the normal range, and the anxiety scores of 14 students had been reduced to low levels of anxiety.

Keywords: Health-related Physical Fitness; Anxiety; Physical Fitness Training Method; Anxiety Training Method

Introduction

The outline of the "Healthy China 2030" project states that health education should be considered an important part of school education, aiming to improve the health level of teenagers, cultivate sports hobbies, and achieve more than 25 percent compliance with national physical health standards by 2030 (Zhong, 2018). The Chinese government attaches special importance to the physical health of teenagers and has taken many measures to improve students' physical health levels. To effectively address the



outstanding physical health problems of students, on May 7, 2022, the CPC Central Committee and the State Council issued the "See the Law on Strengthening Youth Sports and Integrating Youth Physical Fitness," which takes a series of measures to integrate students' physical health into "sunshine sports" as the main focus. Results of the national physical fitness test in September 2022 found that the physical fitness of university students continues to decline but decreases significantly. The survey results showed that in addition to the index before bending in the sitting position, physical fitness levels of the 19-22 age group, such as explosive power, strength, and endurance, also decreased. However, compared to five years ago, the decline decreased significantly (Chen, 2012).

The pressure in both study and life puts higher requirements on the mental quality of university students. The living conditions of contemporary university students are excellent, and the era of Internet big data has brought more comfortable conditions and wider space to their lives. However, this leads to a poor ability to adapt to society, intense thinking, and lack of self-control, which often cause mental health problems among university students. However, mental health problems among college students are some of the hardest to identify, difficult to resolve, and contribute to the growth of core problems. The current level of mental health among university students is worrying. The pressures of study, employment, love, family, and other areas cause some students to develop depression, self-harm, and even more serious psychological symptoms. Not only is the student's development limited, but it also brings danger to students, school, society, and family.

Although there are researchers from the perspectives of sports psychology and sports society regarding the level of physical activity and mental health of university students, there is less research on the nature of sports activities, patterns of sports participation, time allocation for sports involvement, and their relationship with mental health. This makes the research that is beneficial to mental health less concrete. Participation in sports activities itself lacks three scientific recommendations, leading to sports education lacking the connotation of a complete, all-round education. Teaching physical education not only improves physical quality but also improves the level of mental health, which is an important measure that gives sports and universities the power to develop moral, intellectual, physical, aesthetic, and labor abilities.

However, the research problem addresses a growing concern about the physical and mental health of young adults in academic settings. University students frequently experience high levels of stress, sedentary behavior, and poor lifestyle choices, which can lead to deteriorating physical health and increased mental health issues like anxiety and depression (Huang et al., 2022). In Xi'an, these challenges are exacerbated by rapid urbanization and academic pressures unique to Chinese universities, necessitating targeted interventions. This study aims to create a comprehensive exercise program that not only improves students' physical fitness but also benefits their mental health, promoting overall well-being and academic success.

This study aims to investigate the relationship between sports lifestyle and psychology among university students in Xi'an. Firstly, the sports lifestyle and mental health of university students in Xi'an were examined to understand the current situation, influencing factors, rules, and characteristics of university students' sports lifestyle and mental health. Secondly, researching the relationship between sports lifestyle and mental health can provide a basis for university students to build a healthy and scientific sports lifestyle. Conversely, it is a reference for physical education staff at Xi'an University to optimize teaching methods and content in physical education teaching. This will help students have a good physical lifestyle and promote the healthy development of university students' mental health,



creating a scientific sports lifestyle to guide students to promote mental health growth.

Objectives

To evaluate of health-related physical fitness and anxiety within the group between pre-test, 4 texts, 6 texts, and 8 texts.

Literature Review

Localizing Research in Sports Testing

Sports testing is a crucial aspect of assessing physical health among university students. This literature review aims to examine recent research conducted in various regions of China, focusing on the methodologies employed, findings, and implications for enhancing the physical health of university students.

Wu, et al. (2018), and colleagues conducted research at Zhengzhou University, utilizing questionnaire surveys and sampling surveys to assess the physical health of students. By comparing physical health testing results, the researchers proposed measures and suggestions tailored to the specific context of Zhengzhou University.

Shi Huiying, Wang Hui, et al. (2018), and their team analyzed physical fitness test data from a university in Anhui Province. Employing literature review, measurement, questionnaire survey, and mathematical statistics, they identified factors contributing to weak physical fitness among students and suggested strategies for improvement.

Guo and Fan (2022) investigated physical fitness testing and the future direction of physical education and teaching reform among medical university students. Using data from a Western Medical University, they employed methods such as literature review, interviews, and descriptive statistics to provide insights into physical education reform.

Ye's (2021) report highlights the psychological benefits of regular physical exercise, including reductions in somatization, anxiety, depression, paranoia, terror, and sensitivity, ultimately promoting mental health among university students.

Sun's (2022) literature abstract emphasizes the positive impact of sports on the physical and mental health of university students. Engaging in sports not only strengthens the body and improves physical quality but also enhances self-confidence and fosters strong and optimistic qualities.

Lin (2019)'s study explores the relationship between sports participation behaviors and mental health among university students. Findings suggest that higher intensity and frequency of physical exercise are associated with better mental health outcomes.

In conclusion, recent research in China underscores the importance of sports testing and physical exercise in promoting the overall well-being of university students. Strategies for enhancing physical health should be tailored to the specific context of each institution, considering factors such as regional differences and student demographics.

The Influence of Physical Exercise on Emotion and Mental Health: A Review

Research conducted over the past two decades has explored the relationship between physical exercise and its impact on emotion and mental health. This literature review aims to summarize and synthesize findings from both domestic and foreign studies to provide insights into the positive effects of physical exercise on emotional regulation, psychological resilience, and overall mental well-being among university students.

2.1 Positive Effects of Physical Exercise on Emotional Regulation and Psychological Resilience

Stubbs, Al, Hallgren, et al. (2017) conducted a comprehensive review of research spanning the past 20 years, which consistently demonstrated the positive influence of physical exercise on improving emotion. Perchtold-Stefan (2020) proposed that increased physical exercise could enhance cognitive reappraisal, leading to higher psychological resilience and subjective well-being among individuals. Similarly, Yoshikawa et al. (2016) found that regular physical exercise among university students led to improved psychological resilience and reduced depressive symptoms, mediated by increased social support and psychological resilience.

Foreign scholars, such as Sampedro-Piquero (2021), have delved into the molecular mechanisms underlying physical exercise's role in promoting psychological resilience, highlighting its regulatory effect on gene activity, particularly FKBP5. Additionally, Brand (2018) found that physical exercise enhanced emotional regulation and cognitive reappraisal strategies, leading to better emotional control and reduced responses to negative stimuli.

2.2 Reduction of Psychological Pressure and Stress Response

Numerous studies have shown that physical exercise helps combat psychological pressure and reduces stress responses among individuals. Gerber et al. found that individuals engaging in moderate to high-intensity exercise perceived lower levels of pressure. Similarly, Kobasa's research indicated that regular exercise reduced stress responses and increased resilience to setbacks. Aldana (2018) demonstrated that moderate-intensity exercise during leisure time significantly reduced perceived stress levels. Willis et al. further corroborated these findings, showing that physical exercise enhanced physical fitness, aiding individuals in coping with psychological stress and adapting to stressful environments.

To sum up, physical exercise emerges as a crucial factor in promoting mental health and emotional well-being among university students. The reviewed studies highlight its positive effects on emotional regulation, psychological resilience, and stress reduction. Moreover, the relationship between physical exercise and mental health underscores the importance of integrating physical activity into university curricula to address psychological challenges effectively.

2.3 Implications for Future Research

The existing literature provides a foundation for further research into the specific mechanisms through which physical exercise influences mental health. Future studies could employ experimental designs to explore causal relationships and intervention strategies aimed at enhancing the mental well-being of university students through targeted physical exercise programs.

Conceptual Framework

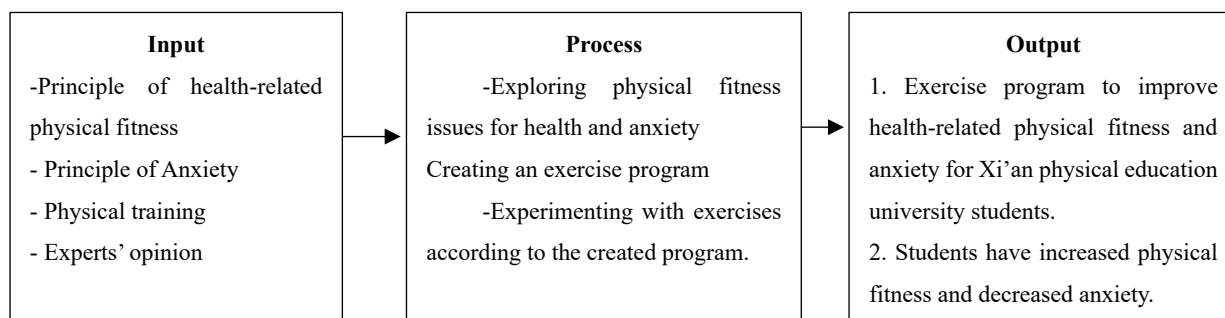


Figure 1 Conceptual Framework

Methodology

This research is R&D, the research method included a literature review on the physical fitness of 1000 students with low physical fitness and high anxiety at Xi'an Physical Education University. Researchers surveyed the anxiety levels of forty-five university students with high anxiety using a specified sampling method. The results of the physical fitness test and anxiety were obtained through a semi-structured questionnaire and the draft exercise program was developed based on experts' deep interviews. Subsequently, researchers implemented an experimental exercise program. Finally, the exercise program was confirmed through a survey.

Results

Before designing the exercise program, the physical fitness of 1,000 non-sports major undergraduates at Xi'an Physical Education University was tested. The results showed that only 400 non-sports major undergraduates' physical fitness scores were fully qualified. The remaining 600 undergraduate students who were not majoring in physical education all had unsatisfactory scores in certain categories. This ratio shows that more than half of the students failed the physical fitness test. These events include 11 test items including height, weight, BMI, vital capacity, 50-meter run, standing long jump, seated forward bend, 800-meter middle-distance run, 1000-meter middle-distance run, one-minute crunches, and one-minute pull-ups. The number of students with unsatisfactory results accounts for 600 students. This unsatisfactory result is in great need of change. The physical fitness scores of students are not ideal and there are many unqualified students.

After an eight-week exercise program trial, the designed exercise program was effective. It can improve students' physical fitness and reduce students' anxiety. This study conducted a physical fitness test on 45 students selected through a special sampling method and concluded that 42 students eventually reached the normal range in terms of BMI, and the remaining three students' BMI values gradually returned to the normal range. In the spirometry test, 45 students reached the passing level, and all of them passed. In the 50-meter sprint test, 45 students met the passing standard, and all of them passed. In the standing long jump test, all 45 students passed the test. In the seated forward bend test, 45 students met the passing standard, and all of them passed. In the 800-meter middle-distance running test, the passing standard is that freshman and sophomore girls run within 4 minutes and 34 seconds, and sophomore and junior girls run within 4 minutes and 32 seconds. All 22 female students passed. In the 1,000-meter middle-distance running test, the passing standard is that freshman and sophomore boys



run within 4 minutes and 32 seconds, and sophomore and junior boys run within 4 minutes and 30 seconds. All 23 male students passed. In the sit-up test event, the final results of the freshman and sophomore girls reached 26 in one minute, and the final results of the junior and senior girls reached 27 in one minute. All 22 girls in total were deemed to have passed the test. qualified. In the pull-up test, the results of the freshman and sophomore boys reached 10 in one minute, and the final results of the junior and senior boys reached 11 in one minute. They were all deemed to have passed the test. A total of 23 boys. qualified.

In the anxiety test, after eight weeks of physical exercise, the anxiety scores of 31 students were within the normal range, and the anxiety scores of 14 students had been reduced to low anxiety.

Table 1 : Mean and standard deviation of physical fitness in pretest, after week 4 after week 6, and After week 8 (n=45)

Variables	Pretest	After week 4	After week 6	After week 8
	Mean \pm S.D.	Mean \pm S.D.	Mean \pm S.D.	Mean \pm S.D.
BMI	21.05 \pm 2.76	20.95 \pm 2.59	20.90 \pm 2.40	20.74 \pm 2.20
Vital Capacity (ml)	2796.76 \pm 753.97	2921.82 \pm 745.80	2931.11 \pm 746.10	3018.11 \pm 765.06
50-meter Run (s)	9.13 \pm 0.93	9.16 \pm 0.93	9.13 \pm 0.93	9.05 \pm 0.90
Standing Long Jump(cm)	191.82 \pm 36.34	191.49 \pm 36.33	191.82 \pm 36.34	197.64 \pm 38.52
Sit and Reach (cm)	187.91 \pm 36.04	7.24 \pm 3.70	7.44 \pm 3.83	8.84 \pm 3.63
800-meter Run(min)	4.31 \pm 0.32	4.21 \pm 0.29	4.21 \pm 0.30	4.16 \pm 0.28
1000-meter Run(min)	4.22 \pm 0.41	4.12 \pm 0.36	4.11 \pm 0.36	18.07 \pm 66.91
Sit up (time)	23.68 \pm 4.18	28.40 \pm 3.50	30.36 \pm 6.60	36.32 \pm 5.36
Pull-ups (time)	9.96 \pm 1.64	10.74 \pm 2.05	10.91 \pm 1.73	12.26 \pm 2.00
Anxiety Score	68.60 \pm 6.57	58.61 \pm 4.63	50.80 \pm 4.05	49.20 \pm 20.50

The table 4.17 displays the median and standard deviation values for each test item as follows:

1. BMI has median and standard deviation values of 21.05 \pm 2.76, 20.95 \pm 2.59, 20.90 \pm 2.40, and 20.74 \pm 2.20, respectively.
2. Vital Capacity (ml) has median and standard deviation values of 2796.76 \pm 753.97, 2921.82 \pm 745.80, 2931.11 \pm 746.10, and 3018.11 \pm 765.06, respectively.
3. 50-meter Run (s) has median and standard deviation values of 9.13 \pm 0.93, 9.16 \pm 0.93, 9.13 \pm 0.93, and 9.05 \pm 0.90, respectively.
4. Standing Long Jump (cm) has median and standard deviation values of 191.82 \pm 36.34, 191.49 \pm 36.33, 191.82 \pm 36.34, and 197.64 \pm 38.52, respectively.



5. Sit and Reach (cm) has median and standard deviation values of 187.91 ± 36.04 , 7.24 ± 3.70 , 7.44 ± 3.83 , and 8.84 ± 3.63 , respectively.
6. The 800-meter Run (min) has median and standard deviation values of 4.31 ± 0.32 , 4.21 ± 0.29 , 4.21 ± 0.30 , and 4.16 ± 0.28 , respectively.
7. The 1000-meter Run (min) has median and standard deviation values of 4.22 ± 0.41 , 4.12 ± 0.36 , 4.11 ± 0.36 , and 18.07 ± 66.91 , respectively.
8. Sit-up (time) has median and standard deviation values of 23.68 ± 4.18 , 28.40 ± 3.50 , 30.36 ± 6.60 , and 36.32 ± 5.36 , respectively.
9. Pull-ups (time) have median and standard deviation values of 9.96 ± 1.64 , 10.74 ± 2.05 , 10.91 ± 1.73 , and 12.26 ± 2.00 , respectively.
10. Anxiety Score has median and standard deviation values of 68.60 ± 6.57 , 58.61 ± 4.63 , 50.80 ± 4.05 , and 49.20 ± 20.50 , respectively.

Table 2 : The comparison within the experiment group on physical fitness between pre-test, after week 4, after 6 weeks, and after 8 weeks by ANOVA Repeated measurement

Variables	Source of variant	Type III Sum of Squares	df	MS	F	p
BMI	Week	2.28	3	.76	4.94	.01*
	Error	20.27	132	.15		
	total	22.55	135	.90		
Vital Capacity (ml)	Week	1120704.77	3	373568.26	29.85	.00*
	Error	1652036.48	132	12515.43		
	total	2772741.25	135	386083.69		
50-meter Run(s)	Week	.35	3	.12	2.73	0.05
	Error	5.59	132	.04		
	total	5.94	135	.16		
Standing Long Jump(cm)	Week	1191.48	3	397.16	29.72	.00*
	Error	1763.77	132	13.37		
	total	2955.25	135	410.53		
Sit and Reach (cm)	Week	1094387.39	3	364795.80	1022.25	.00*
	Error	47105.08	132	356.86		
	total	1141492.47	135	365152.66		
800-meter Run(min)	Week	.27	3	.09	14.68	.00*
	Error	.38	63	.01		
	total	0.65	66	.10		
1000-meter Run(min)	Week	3340.27	3	1113.42	.99	.40
	Error	74273.75	66	1125.36		
	total	77614.02	69	2238.78		
Sit up (time)	Week	1531.76	3	510.59	87.77	.00*
	Error	366.49	63	5.82		
	total	1898.25	66	516.41		
Pull-ups (time)	Week	63.25	3	21.08	18.07	.00*



Variables	Source of variant	Type III Sum of Squares	df	MS	F	p
Anxiety Score	Error	77.00	66.00	1.17		
	total	140.25	69	22.25		
	Week	10632.60	3	3544.20	241.08	.00*
	Error	1940.58	132	14.70		
	total	12573.18	135	3558.90		

*P< .05

From the variables in Table 4.18, BMI, Vital Capacity (ml), 50-meter Run(s), Standing Long Jump(cm), Sit and Reach (cm), 800-meter Run(min), 1000-meter Run (min), Sit-up (time), Pull-ups (time), and Anxiety Score were significantly different at <.05 in at least one pair.

Table 3 : The LSD post hoc of pairwise comparisons was conducted for physical fitness on the pretest, after weeks 4, after week 6, and after week 8.

Variable	Test	Pretest	After weeks 4	After weeks 6	After weeks 8
BMI	Pretest	XXX	0.10	.15*	.31*
	After weeks 4		XXX	.05	.21*
	After week 6			XXX	.16
	After week 8				XXX
Vital Capacity(ml)	Pretest	XXX	-125.07*	-134.36*	-221.36*
	After weeks 4		XXX	-9.29	-96.29*
	After week 6			XXX	-87.00*
	After week 8				XXX
50-meter Run(s)	Pretest	XXX	-.03*	.00	0.90
	After weeks 4		XXX	.03*	.11
	After week 6			XXX	0.90
	After week 8				XXX
Standing Long Jump(cm)	Pretest	XXX	.33*	.00	-5.82*
	After weeks 4		XXX	-.33*	-6.16*
	After week 6			XXX	-5.83*
	After week 8				XXX
Sit and Reach (cm)	Pretest	XXX	180.67*	180.46*	179.07*
	After weeks 4		XXX	-.20*	-1.60
	After week 6			XXX	-1.40*
	After weeks 8				XXX
800-meter Run(min)	Pretest	XXX	0.10*	0.11*	.15*
	After weeks 4		XXX	.01	.53*
	After week 6			XXX	.44*
	After weeks 8				XXX



Variable	Test	Pretest	After weeks 4	After weeks 6	After weeks 8
1000-meter Run(min)	Pretest	XXX	.10*	.11*	-13.85*
	After weeks 4		XXX	.00	-13.95
	After week 6			XXX	-13.95
	After weeks 8				XXX
Sit up (time)	Pretest	XXX	-4.73*	-6.68*	-6.91*
	After weeks 4		XXX	-1.10*	-6.91*
	After week 6			XXX	-4.96*
	After weeks 8				XXX
Pull-ups (time)	Pretest	XXX	-0.78	-.96*	-2.30*
	After weeks 4		XXX	-.17	-1.52*
	After week 6			XXX	-1.35*
	After weeks 8				XXX
Anxiety Score	Pretest	XXX	9.10*	17.80*	19.40*
	After weeks 4		XXX	7.81*	9.41*
	After week 6			XXX	1.60*
	After weeks 8				XXX

The LSD post hoc pairwise comparisons on the pretest, after weeks 4, after week 6, and after week 8 in table 4.19 between BMI, Vital Capacity (ml), 50-meter Run(s), Standing Long Jump(cm), Sit and Reach (cm), 800-meter Run(min), 1000-meter Run (min), Sit-up (time), Pull-ups (time), and Anxiety Score showed significant differences at <0.05 in at least one pair.

Knowledge Contribution

The data provided can be classified into categories based on the physical fitness components tested, both before and after the exercise program. Here's a classification of each item:

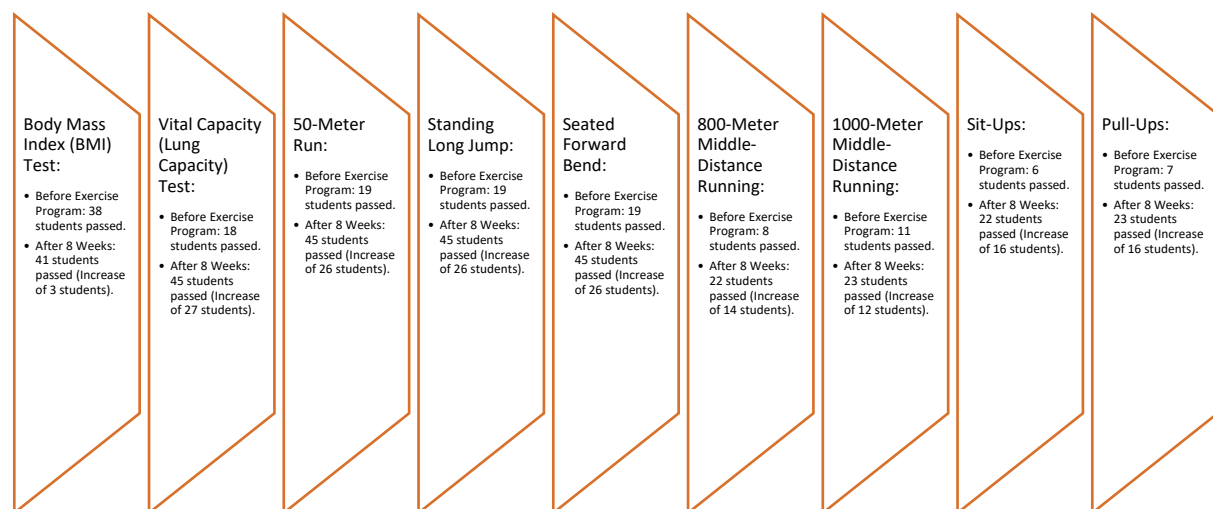


Figure 2 Knowledge Contribution



This classification shows the improvements in each specific physical fitness category after the implementation of the exercise program.

Discussion

Through the experiment with the development of an exercise program, it can be seen that the students' physical fitness has been significantly improved and their anxiety has been significantly reduced, indicating that the exercise program of this study is effective. Comparing the physical fitness test data of students before exercise, and after eight weeks of testing.

In the first test, 38 students passed the BMI test, 18 students reached the pass standard for vital capacity, 19 students reached the pass standard for the 50-meter run, 19 students reached the pass standard for the standing long jump, and 19 students reached the pass standard for the sitting body. 17 students met the passing standard for forward bending, 8 students met the passing standard for the 800-meter middle-distance running, 11 students met the passing standard for the 1000-meter middle-distance running, and 6 students met the passing standard for sit-ups and pull-ups. Standard has 7 students.

After 8 weeks of the exercise program experiment, the student's physical fitness test results showed that there were 41 students with qualified BMI, one more student than the six-week test results. There were 45 students whose lung capacity reached the passing standard, an increase of 5 compared to the six-week test. 45 students met the passing standard in the 50-meter run, an increase of six students from the number who passed the six-week test. 45 students met the passing standard in the standing long jump, an increase of 8 students from the number who passed the six-week test. 45 students met the passing standard for seated forward bending, 8 more than the number who passed the six-week test. 22 students met the passing standard in the 800-meter middle-distance running, an increase of 7 students from the number who passed the six-week test. 23 students met the passing standard in the 1,000-meter middle-distance running, which was an increase of 3 students from the number of qualified students in the six-week test. 22 students met the passing standard for sit-ups, an increase of 5 students from the number who passed the six-week test. 23 students met the passing standard for pull-ups, an increase of 3 students from the number of qualified students in the six-week test.

After 8 weeks of experimenting with the exercise program, the students have all reached the passing standards.

Recommendation

This study has had a significant impact on improving student's physical fitness and reducing anxiety. Nevertheless, it's worth noting that the student samples used in this study were exclusively non-sports majors from Xi'an Physical Education University. Therefore, it is recommended that future research consider a more comprehensive design program that can be optimized to apply to a wider range of majors and undergraduate students from various institutions.

While we acknowledge that there will be challenges and difficulties in expanding the scope of the research, employing robust research and development (R&D) methods can lead to better-designed exercise programs for undergraduate university students, ultimately enabling them to enhance their physical fitness and reduce anxiety. This approach not only enhances the practicality and credibility of the research but also ensures its relevance across diverse academic disciplines.



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