

# Psychological Study on the Influence of Physical Exercise on College Students' Anxiety

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**Abstract:** This study aims to explore the impact of physical exercise on the anxiety level of college students. We collected physical exercise data and anxiety self-assessment results from college students of different grades, genders, and ages from multiple universities in Guangdong Province through a questionnaire survey. The study used standardized scales to evaluate participants' physical exercise types, frequencies, intensities, and anxiety levels. The data analysis results showed that there is a significant negative correlation between college students' physical exercise and anxiety level, that is, the more frequent and intense the physical exercise, the lower the anxiety level. In addition, there are differences in the effect of different types of physical exercises on anxiety relief, with aerobic exercises such as running and swimming showing more significant anxiety-relieving effects. The research results provide valuable references for psychological health education and anxiety intervention strategies in universities and suggest promoting physical exercise to effectively alleviate college students' anxiety.

**Keywords:** College students; Physical activity; Anxiety; Mental health; Questionnaire investigation

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## 1. Introduction

With the rapid development of society and increasingly fierce competition, college students are facing pressure from various aspects such as academics, employment, and interpersonal relationships, leading to a widespread increase in anxiety. Anxiety not only affects college students' academic performance but may also trigger a series of physical and mental health problems, such as sleep disorders and low mood. Thus, alleviating anxiety has become a key research topic. Physical exercise, as a positive form of physical and mental activity, has been widely recognized as having a positive impact on mental health. Numerous studies have shown that physical exercise can promote the release of neurotransmitters such as endorphins in the brain, improve emotional states, and alleviate symptoms of anxiety and depression. However, there may be differences in the effectiveness of anxiety relief among different types of physical exercise, as well as different exercise frequencies and intensities.

The main objectives of this study include the following aspects: exploring the specific effects of physical

exercise on anxiety levels among college students; analyzing the effects of different types, frequencies, and intensities of physical exercise on anxiety relief through questionnaire surveys and data analysis; comparing the different effects of various types of physical exercise (such as aerobic exercise, anaerobic exercise, flexibility training, etc.) and varying exercise frequencies and intensities on anxiety relief. This study can provide recommendations for universities to develop effective physical exercise plans and anxiety intervention strategies to promote the mental health of college students. It aims to provide new perspectives and methods for mental health education and anxiety intervention in universities through systematic investigation and analysis and to help college students cope with anxiety emotions and alleviate their mental health problems.

## **2. Research hypotheses**

### **2.1. Significant reduction of college students' anxiety levels with physical exercise**

Physical exercise, as a positive physical and mental activity, plays an important role in promoting physical and mental health. Multiple studies have shown that physical activity has a significant effect on alleviating anxiety. Lu and Ji tested trait anxiety among college students using the State-Trait Anxiety Inventory and found significant differences in the impact of different exercise programs and exercise frequencies on trait anxiety among college students <sup>[1]</sup>. Specifically, aerobic exercise such as running, swimming, etc. can significantly improve cardiovascular function, promote blood circulation, and thereby promote the release of neurotransmitters such as endorphins, which can help alleviate anxiety. In addition, Sun *et al.* pointed out that physical exercise, as one of the effective means of preventing and treating anxiety, can improve individuals' mental health through various channels <sup>[2]</sup>. The study by Ye *et al.* showed that the incidence of anxiety among college students in Shanghai is 9.7%, and the rate of poor sleep quality is 55.0%, with significant gender differences <sup>[3]</sup>. Chen *et al.* found through integrated analysis that exercise can effectively regulate the levels of neurotrophic factors and glucocorticoid and the morphological structure of specific parts of the central nervous system, induce hippocampal neurogenesis, and alleviate symptoms of depression <sup>[4]</sup>. Physical exercise can effectively improve emotional states and alleviate anxiety symptoms by promoting the release of neurotransmitters such as endorphins in the brain. Endorphins are naturally occurring chemicals believed to be associated with pleasure and pain relief. Therefore, assuming that physical exercise can significantly reduce college students' anxiety levels and provide them with an effective non-pharmacological anxiety relief method <sup>[5]</sup>.

### **2.2. Varying effects of different physical exercises on alleviating anxiety**

Physical exercise, as an effective means of promoting physical and mental health, takes various forms from light walks to high-intensity strength training. The mechanisms by which different types of exercise affect the body and mind may vary, mainly due to their different effects on physiological responses, psychological states, and social interactions <sup>[6]</sup>. Therefore, it can be reasonably inferred that different types of physical exercise may exert different levels of anxiety relief. Aerobic activities such as running and swimming are generally considered to have a positive impact on mental health. This type of exercise may effectively alleviate anxiety by improving cardiovascular function, promoting blood circulation, releasing accumulated stress, and enhancing the overall metabolic rate of the body. In addition, aerobic exercise can promote the release of natural analgesic substances such as endorphins from the brain, which helps to enhance an individual's sense of pleasure and happiness. In contrast, anaerobic exercise such as strength training, despite having different physiological mechanisms from aerobic exercise, may also have a positive relieving effect on anxiety. Strength training may help individuals improve their confidence and self-efficacy, enabling them to face challenges in life with greater composure and courage, thereby reducing anxiety.

### **2.3. Positive correlation between frequency and intensity of physical exercise and degree of anxiety relief**

In theory, the frequency and intensity of physical exercise play a crucial role in determining its positive psychological and physiological effects [7]. Continuous and high-intensity physical exercise not only helps to improve overall physical health but also significantly enhances an individual's psychological resilience, thereby more effectively alleviating anxiety [8]. This is because high-frequency and high-intensity exercise can comprehensively promote the functions of various systems in the body, including the cardiovascular system, nervous system, and endocrine system. The optimized operation of these systems is crucial for maintaining a positive psychological state. Therefore, we propose the hypothesis that the frequency and intensity of physical exercise are positively correlated with the degree of anxiety relief. Specifically, this means that the more frequent and intense the physical exercise, the better the effect of anxiety relief may be. This hypothesis emphasizes the importance of the continuity and intensity of physical exercise in anxiety relief, suggesting that to achieve better anxiety relief effects, individuals need to maintain a certain frequency of exercise and ensure that each exercise reaches a certain intensity. This assumption provides important guidance for designing effective physical exercise intervention plans. When developing an exercise plan, one should consider the individual's actual situation and needs, and arrange the frequency and intensity of exercise reasonably to ensure that the exercise plan is both feasible and effective.

## **3. Research methodology**

### **3.1. Research subjects**

The study focused on college students from five universities in Guangdong Province, covering students of different grades (freshman to senior), genders (male and female), and multiple professional fields. In order to ensure the scientific and effective nature of the research, we designed a detailed and comprehensive questionnaire to collect relevant data on participants' basic information, physical exercise habits, frequency, intensity, and anxiety levels. The questionnaire was self-designed based on existing mature questionnaires and adapted appropriately according to the specific needs of this study. The questionnaire was designed with reference to authoritative scales in relevant fields both domestically and internationally, such as the International Physical Activity Questionnaire (IPAQ) and the State-Trait Anxiety Inventory (STAI), to ensure the scientific and effective content of the questionnaire. The standardized STAI was used to assess participants' anxiety levels using the trait anxiety subscale. This scale has been validated multiple times and has high reliability and validity, accurately reflecting an individual's anxiety state. To ensure the reliability of the questionnaire, we conducted a pre-survey before the formal investigation, collected data from some students, and conducted a reliability analysis. The internal consistency reliability of the questionnaire was evaluated by calculating Cronbach's alpha coefficient. The results showed that Cronbach's alpha coefficients for the assessment of physical exercise habits and anxiety levels were both above 0.8, indicating that the questionnaire has high reliability in measuring participants' physical exercise habits and anxiety levels. The questionnaire was distributed to the target audience through a combination of online and offline methods. The collected questionnaire data underwent a rigorous screening and cleaning process, removing invalid and outlier values, and ultimately retained 1,077 valid questionnaires for subsequent analysis.

### **3.2. Data collection and processing**

Data collection was mainly completed through questionnaire surveys. After a rigorous screening and cleaning process, invalid and outlier values were removed, and the valid questionnaire was ultimately retained for

subsequent analysis. Statistical measures such as the mean and standard deviation were used for calculating participants' basic information, physical exercise habits, and anxiety levels to comprehensively understand the overall characteristics of the sample. Correlation analysis was conducted to preliminarily explore the degree of correlation between physical exercise and anxiety level by calculating the correlation coefficient between the two. Finally, in order to further explore the independent effect of physical exercise on anxiety levels and control for other potential confounding factors such as gender, grade, etc., a regression model was established for regression analysis.

## 4. Data analysis and results

### 4.1. Descriptive statistical analysis

This study conducted descriptive statistical analysis on 1,077 valid questionnaire data using SPSS software, aiming to reveal the basic characteristics of the sample and the distribution of the main variables.

#### 4.1.1. Basic information statistics of participants

The basic information of the participants is shown in **Tables 1** and **2**.

**Table 1.** Participants' gender and age

Classification	Subcategory	Information	Percentage
Gender	Male	639	59.5%
	Woman	438	40.5%
Age	Range	19 to 22 years old	39.2%
	Average age	21 years old	27.7%

**Table 2.** Grades of college students

Grade	<i>n</i>	Percentage
Freshman	193	18.0%
Sophomore	777	72.1%
Junior	75	6.9%
Senior	32	3.0%

#### 4.1.2. Physical exercise statistics

**Tables 3, 4, and 5** show the distribution of physical exercise types, frequency, and intensity of physical exercise. The distribution of self-reported anxiety scale scores is presented in **Table 6**, while the gender and grade differences in anxiety levels are shown in **Tables 7 and 8**.

**Table 3.** Distribution of physical exercise types

Type of physical exercise	<i>n</i>	Percentage
Aerobic exercise (e.g., running, swimming)	642	59.8%
Anaerobic exercise (e.g., strength training)	231	21.4%
Flexibility training (e.g., yoga, stretching)	204	19.0%

**Table 4.** Frequency of physical exercise

Frequency of physical exercise	<i>n</i>	Percentage
1–2 times per week	312	29.0%
3–4 times per week	489	45.4%
5 or more times per week	276	25.6%

**Table 5.** Intensity of physical exercise

Intensity of physical exercise	<i>n</i>	Percentage
Light activity (e.g., walking)	213	19.8%
Moderate activity (e.g., brisk walking, light jogging)	512	47.7%
Vigorous activity (e.g., intense exercise, fast running)	352	32.7%

**Table 6.** Distribution of self-reported anxiety scale scores

Metric	Value
Average score	42.3
Standard deviation	10.5
Score range	20–70

**Table 7.** Gender differences in anxiety levels

Gender	Average score	Standard deviation
Female	44.7	11.2
Male	40.5	9.6

**Table 8.** Grade differences in anxiety levels

Grade	Average score	Standard deviation
Freshman	45.2	11.0
Sophomore	42.0	10.3
Junior	40.8	9.8
Senior	41.5	10.1

## 4.2. Correlation analysis

Based on **Table 9**, there is a significant negative correlation between physical exercise and anxiety levels. Specifically, both the overall level of physical exercise and each exercise type such as aerobic exercise, anaerobic exercise, and flexibility training show a negative correlation with anxiety levels, indicating that higher physical exercise levels are associated with lower anxiety levels. Among these, aerobic exercise has the most pronounced negative correlation with anxiety, with a correlation coefficient of  $-0.51$ , suggesting that aerobic exercise may be particularly effective in alleviating anxiety. Additionally, both the frequency and intensity of physical exercise show significant negative correlations with anxiety levels, indicating that increasing the frequency or intensity of physical exercise can help reduce anxiety (**Table 10**). Physical exercise has a positive effect on alleviating anxiety. Different types of physical exercise, as well as varying frequencies and intensities, may have different impacts on anxiety levels. Therefore, when designing physical exercise programs to alleviate

anxiety, it is important to consider these factors to achieve the best outcomes.

**Table 9.** Correlation analysis between physical exercise and anxiety levels

Physical exercise	Correlation coefficient with anxiety level ( <i>r</i> )	Significance ( <i>P</i> )
Overall physical exercise level	-0.45	< 0.001
Aerobic exercise	-0.51	< 0.001
Anaerobic exercise	-0.27	< 0.01
Flexibility training	-0.22	< 0.05

**Table 10.** Correlation analysis between frequency and intensity of physical exercise and anxiety level

Metric	Correlation coefficient with anxiety level ( <i>r</i> )	Significance ( <i>P</i> )
Physical exercise frequency	-0.39	< 0.001
Physical exercise intensity	-0.48	< 0.001

### 4.3. Regression analysis

According to **Table 11**, the regression analysis results show the impact of physical exercise levels (including weekly exercise frequency, exercise duration, and exercise intensity), as well as variables such as gender, age, and grade, on anxiety levels.

Weekly exercise frequency (A1) has a regression coefficient of -0.7, a standard error of 0.2, a *t* value of -3.6, and a significance level < 0.001, indicating a significant negative correlation between weekly exercise frequency and anxiety levels.

Exercise duration (A2) has a regression coefficient of -0.5, a standard error of 0.1, a *t* value of -4.8, and a significance level < 0.001, showing a significant negative correlation between exercise duration and anxiety levels.

Exercise intensity (A3) has a regression coefficient of -0.6, a standard error of 0.1, a *t* value of -5.9, and a significance level < 0.001, indicating a significant negative correlation between exercise intensity and anxiety levels.

Gender (male = 0, female = 1) has a regression coefficient of 2.3, a standard error of 0.4, a *t* value of 5.6, and a significance level < 0.001, suggesting that the average anxiety level for females is 2.3 points higher than for males.

Age has a regression coefficient of 0.1, a standard error of 0.03, a *t* value of 3.1, and a significance level < 0.01, indicating that anxiety levels increase by 0.1 points for each additional year of age.

Grade (freshman = 1, senior = 4) has a regression coefficient of -0.4, a standard error of 0.2, a *t* value of -2.1, and a significance level less than 0.05, showing that higher grades are associated with lower anxiety levels.

The results from the regression analysis indicate that physical exercise levels (including weekly exercise frequency, exercise duration, and exercise intensity) have significant independent effects on anxiety levels. This effect is observed across different genders, ages, and grades. Therefore, developing a well-rounded physical exercise plan, including appropriate exercise frequency, duration, and intensity, can effectively reduce anxiety levels <sup>[9]</sup>.

**Table 11.** Regression analysis of physical exercise levels on anxiety levels

Variable	Regression coefficient ( $\beta$ )	Standard error	<i>t</i>	Significance ( <i>P</i> )	95% confidence interval
Aerobic exercise (A1)	-0.7	0.2	-3.6	< 0.001	[-0.11, -0.29]
Anaerobic exercise (A2)	-0.5	0.1	-4.8	< 0.001	[-0.07, -0.33]
Exercise intensity (A3)	-0.6	0.1	-5.9	< 0.001	[-0.08, -0.42]
Gender (male = 0, female = 1)	2.3	0.4	5.6	< 0.001	[1.5, 3.1]
Age	0.1	0.03	3.1	< 0.01	[0.04, 0.16]
Grade (freshman = 1, senior = 4)	-0.4	0.2	-2.1	< 0.05	[-0.8, 0.0]

## 5. Conclusion and recommendations

This study collected physical exercise data and self-reported anxiety results from college students across multiple universities in Guangdong Province using a questionnaire survey, exploring the impact of physical exercise on college students' anxiety levels. The data analysis reveals a significant negative correlation between physical exercise and anxiety levels in college students. This finding aligns with existing research that suggests a positive impact of physical exercise on mental health<sup>[10]</sup>. Aerobic exercises, such as running and swimming, show a more pronounced effect in alleviating anxiety, while anaerobic exercises and flexibility training also contribute to reducing anxiety, though to a lesser extent. Additionally, the frequency and intensity of physical exercise are positively correlated with the degree of anxiety relief, suggesting that more frequent and higher-intensity exercise may yield better anxiety-reducing effects. Even after controlling for variables such as gender, age, and grade, the regression analysis supports the independent effect of physical exercise levels on anxiety levels. This highlights the potential of physical exercise as an effective non-pharmacological intervention for alleviating anxiety in college students.

Based on the main findings, some recommendations are provided: (1) Exercise-based anxiety intervention strategy: Universities should develop and promote diversified physical exercise programs, including aerobic exercise, anaerobic exercise, and flexibility training. Students are encouraged to engage in regular physical exercise, at least 3–5 times per week, with each session lasting 30 to 60 minutes, to achieve optimal anxiety relief. (2) College mental health education: Physical exercise is incorporated into the core content of mental health education, emphasizing its importance in preventing and alleviating anxiety. A linkage mechanism between physical exercise and mental health is established to provide comprehensive psychological support for students.

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## Disclosure statement

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