

# An Empirical Study on the Relationship between Physical Exercise and Social Anxiety among Junior High School Students: A Case Study of County Y, City L

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**Abstract** As mental health issues among adolescents receive increasing attention, the impact of physical exercise on mental health has become prominent. In this paper, junior high school students in Luoding County and Yunan County of Yunfu are taken as participants. It employs a convenient sampling method to distribute questionnaires, utilizes relevant scales for measurement, and analyzes the data with the assistance of SPSS 26.0. The results indicate a significantly negative correlation between physical exercise and social anxiety. Overall, junior high school students in this region engage in relatively weak physical exercise, and their social anxiety is at a moderate level, with female students being more prone to anxiety. Left-behind children exhibit higher levels of social anxiety compared to non-left-behind children. There are notable differences among group characteristics, with social and cultural factors and physiological factors influencing gender differences, and the lack of family support affecting the social anxiety of left-behind children. This study provides a basis for intervening in psychological anxiety and other issues. It is suggested deepening the sports collaborative education mechanism, paying attention to the cultivation of social and emotional abilities of left-behind children, and using physical exercise to promote the development of students' social adaptability.

**Key words** Physical exercise; Social anxiety; Gender difference

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With the rapid development of modern society, mental health issues among adolescents, particularly social anxiety, have increasingly garnered societal attention. The *Opinions on Comprehensively Strengthening and Improving School Sports Work in the New Era* issued by the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council emphasize that physical activities play a core role in promoting students' comprehensive development and enhancing their mental health levels<sup>[1]</sup>. Driven by strategic goals such as building a sports power and a healthy China, physical exercise plays a crucial role in enhancing people's sense of happiness and has a profound impact on their mental health<sup>[2]</sup>. Inadequate exercise behavior affects the manifestation of self-confidence<sup>[3]</sup>, which can lead to social anxiety among students and impact their mental health status<sup>[4]</sup>.

## 1 Literature review

Social anxiety is an emotional state frequently experienced by adolescents<sup>[5]</sup>, referring to the anxiety an individual may experi-

ence in interpersonal interactions, often related to strong fears and concerns about others' evaluations. When this social phobia becomes extreme, it may evolve into social anxiety disorder<sup>[6]</sup>. Adolescence is a critical period for forming social and emotional habits that are crucial for mental health (World Health Organization, 2021). Social anxiety not only affects junior high school students' academic performance<sup>[7]</sup> and interpersonal interactions<sup>[8]</sup> but may also have a profound impact on their future social adaptability. Therefore, addressing the issue of social anxiety among junior high school students and improving their social anxiety levels have become urgent problems to be solved.

Among the various factors affecting individual mental health, the positive impact of physical activity is increasingly recognized and valued. Numerous studies have pointed out the positive effects of physical activity on reducing social anxiety. Tao Ping's research in 2012 indicated that reasonable exercise frequency and content can help primary and middle school students release stress, reduce negative emotions, and enhance their physical and psychological qualities<sup>[9]</sup>. This study supports the theory of personality maturation and the positive psychological development perspective in the emotional development of adolescents. Hegberg *et al.* pointed out that physical exercise can increase individuals' psychological resilience when facing stress and reduce the incidence of mental health problems<sup>[10]</sup>. Sun Chongyong *et al.*<sup>[11-12]</sup> confirmed that middle school students can obtain positive emotional experiences through physical exercise, promote the improvement of their psychological capital levels, and thus exhibit better psychological qualities. Par-

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ticipating in different forms of physical exercise can also reduce fear and anxiety towards social situations and other negative emotions. For example, moderate-intensity basketball<sup>[13]</sup>, aerobics<sup>[14]</sup>, and rope skipping<sup>[15]</sup> can alleviate students' anxiety and have a positive impact on their mental health. Through a survey of 797 left-behind children, Ren *et al.*<sup>[16]</sup> found that the duration, intensity, and frequency of physical exercise significantly affect the social anxiety of left-behind children.

The *China Youth Sports Development Report* points out that the participation of rural primary and middle school students in physical activities is significantly lower than that of urban students<sup>[3]</sup>. In view of this, this study aims to deeply explore the impact and mechanism of physical exercise on social anxiety among junior high school students. By distributing questionnaires, it analyzes the current situation and problems of middle school students in Luoding County and Yunan County in terms of physical exercise and social anxiety, and delves into the influence path of the two in a longitudinal manner, providing empirical research support for preventing and alleviating social anxiety among middle school students.

## 2 Research methods

**2.1 Participants** This study employs a convenient sampling method to distribute questionnaires to junior high school students in several middle schools of Yunan County and Luoding County. During the research process, a total of 2 000 paper questionnaires were distributed, with 1 953 being recovered, representing a recovery rate of 97.65%. After eliminating duplicate and invalid questionnaires, 1 652 valid questionnaires were collected, with an effective recovery rate of 82.6%. The survey participants cover students from all three grades of junior high school. In the design and implementation of this study, strict control was exercised over key variables such as the participants' gender and grade to ensure the scientificity and validity of the research results.

### 2.2 Measurement tools

**2.2.1 Physical Activity Rating Scale (PARS-3).** This study uses the *Physical Activity Rating Scale* revised by Professor Liang Deqing to measure the physical exercise situation of junior high school students. The exercise scale mainly includes measurements of time, intensity, and frequency, using the Likert scale for scoring. The calculation method for exercise proposed by Professor Liang Deqing is adopted:  $\text{intensity} \times (\text{time} - 1) \times \text{frequency} = \text{physical exercise volume}$ . After calculating the participants' physical exercise volume, the level of physical activity is divided based on  $\leq 19$  as low activity,  $20 - 42$  as moderate activity, and  $\geq 43$  as high activity, with the level serving as an evaluation indicator for physical exercise. The Cronbach  $\alpha$  coefficient of this scale in this study is 0.85.

**2.2.2 Interaction Anxiousness Scale.** This study uses the *Interaction Anxiousness Scale* of the self-awareness scale compiled by scheirer and revised by Wang Xiangdong. The scale is a one-dimensional scale with 6 questions in total. With the consent of ex-

perts, the option is adjusted to Likert 5-point scoring method. The higher the total score, the stronger the individual's communication anxiety. In this study, the Cronbach  $\alpha$  coefficient of the scale is 0.838.

**2.2.3 Statistical analysis.** The statistical software used in this study is SPSS 26.0 for statistical analysis of the research data.

## 3 Research results and analysis

### 3.1 Descriptive statistics and correlation analysis of physical exercise and social anxiety

**3.1.1 Descriptive statistics on the impact of physical exercise on social anxiety.** According to Professor Liang Deqing's *Physical Activity Rating Scale*, it is divided into three parts: exercise intensity, exercise duration, and exercise frequency. Table 1 presents the exercise situation of the survey participants over the past month. The results show that the average exercise duration is the highest, at 3.29 points, while the average exercise intensity and exercise frequency are both below 3 points. Based on the evaluation criteria, the average exercise volume is 14.96 points, with a standard deviation of 13.689 points. The average is below 19 points, indicating low activity level. This suggests that junior high school students in the survey area generally engage in weak physical exercise but have a relatively large degree of dispersion. The average exercise intensity is 2.63 points, indicating that most students have maintained low-intensity, less stressful exercise over the past month. In terms of exercise duration, the average is 3.23 points, suggesting that most junior high school students participate in exercise for 21–30 min in the past month. In terms of exercise frequency, the average is 2.50 points, indicating that most junior high school students maintain an exercise frequency of more than 2–3 times a month.

The minimum score of the *Interaction Anxiousness Scale* is 1 point, the maximum is 5 points, and the average is 2.836 points, indicating that the overall social anxiety in the area is at a moderate level, and there are students with higher anxiety levels.

**Table 1 Descriptive statistics** points

Item	Minimum	Maximum	Average	Deviation
Exercise intensity	1	5	2.630	1.420
Exercise duration	1	5	3.290	1.296
Exercise frequency	1	5	2.500	1.039
Exercise volume	0	100	14.960	13.689
Social anxiety	1	5	2.836	0.951

**3.1.2 Correlation analysis on the impact of physical exercise on social anxiety.** As shown in Table 2, there is a significant correlation between physical exercise and social anxiety. Among the dimensions of physical exercise, exercise intensity, exercise duration, exercise frequency, and exercise volume are all significantly correlated with social anxiety.

The statistical results from Table 3 indicate that the mean and standard deviation for exercise intensity is  $(2.63 \pm 1.42)$  points. Males' scores are higher than females, with a statistically significant gender difference ( $P < 0.01$ ). However, there is no statisti-

cally significant difference between age groups ( $P>0.05$ ), nor is there a statistically significant difference among grades ( $P>0.05$ ). The mean and standard deviation for exercise duration is ( $3.29\pm1.296$ ) points, with males scoring higher than females. There were statistically significant differences in gender, age, and grade for exercise duration ( $P<0.05$ ). The mean and standard deviation for exercise frequency is ( $2.50\pm1.039$ ) points, with males scoring slightly lower than females. There is a statistically

significant gender difference ( $P<0.01$ ), but no statistically significant difference between age groups ( $P>0.05$ ) or among grades ( $P>0.05$ ). The mean and standard deviation for social anxiety is ( $2.836\pm0.951$ ) points, with males scoring slightly lower than females. There is a statistically significant gender difference ( $P<0.01$ ) and a statistically significant difference among grades ( $P<0.05$ ), but no statistically significant difference between age groups ( $P>0.05$ ).

Table 2 Correlation analysis results

Item	Exercise intensity	Exercise duration	Exercise frequency	Exercise volume	Social anxiety
Exercise intensity	1				
Exercise duration	0.389 **	1			
Exercise frequency	-0.262 **	-0.358 **	1		
Exercise volume	0.688 **	0.647 **	0.075 **	1	
Social anxiety	-0.167 **	-0.185 **	0.143 **	-0.127 **	1
Skewness	0.117	-0.269	0.576	1.454	-0.038
Kurtosis	-1.428	-0.968	0.114	3.402	-0.504

Note: \* shows  $P<0.05$ , and \*\* shows  $P<0.01$ .

Overall, there is a significantly negative correlation between physical exercise behavior and its three dimensions (intensity, duration, and frequency) and social anxiety. It indicates that the higher the level of physical exercise among junior high school students, the lower their social anxiety (Table 2). From a macro perspective, the physical activities has a positive impact in regulating negative emotions among junior high school students and promoting educational equity. Based on these research findings, campus physical activities should be regarded as an effective and universally beneficial mental health counseling approach that addresses educational equity, thereby attracting the attention of schools

and parents.

**3.2 Analysis of differences in social anxiety among junior high school students**

**3.2.1** Significant gender differences in social anxiety among junior high school students. Seen from Table 3, regarding the variable of social anxiety, the average score for males is 2.65 points, while for females, it is 2.99 points, with  $P<0.01$ . It indicates that gender differences in social anxiety are statistically significant at a high level. This means that among junior high school students, females are more likely to experience social anxiety than males.

Table 3 Gender differences in social anxiety among junior high school students

Item	Gender	Number of participants	Average//points	Standard deviation//points	P
Exercise intensity	Male	755	3.01	1.378	0.000 **
	Female	897	2.32	1.377	
Exercise duration	Male	755	3.60	1.323	0.000 **
	Female	897	3.03	1.215	
Exercise frequency	Male	755	2.36	1.043	0.000 **
	Female	897	2.62	1.021	
Exercise volume	Male	755	18.26	14.954	0.000 **
	Female	897	12.18	11.841	
Social anxiety	Male	755	2.65	0.936	0.000 **
	Female	897	2.99	0.936	

Note: \* shows  $P<0.05$ , and \*\* shows  $P<0.01$ .

Table 4 Differences in social anxiety between left-behind children and non-left-behind children

Item	Left-behind status	Number of participants	Average//points	Standard deviation//points	P
Exercise duration	Left-behind	862	3.18	1.298	0.000 **
	Non-left-behind	790	3.41	1.284	
Exercise volume	Left-behind	862	14.40	13.548	0.031 *
	Non-left-behind	790	15.57	13.824	
Social anxiety	Left-behind	862	2.88	0.942	0.031 *
	Non-left-behind	790	2.78	0.959	

**3.2.2** Differences in social anxiety between left-behind children and non-left-behind children. From Table 4, it can be seen that the average exercise duration of left-behind children [ $(3.18 \pm 1.298)$  points] is lower than that of non-left-behind children [ $(3.41 \pm 1.284)$  points], with a statistically significant difference ( $P < 0.01$ ) between the two. The average amount of exercise for left-behind children [ $(14.40 \pm 13.548)$  points] is also different from that of non-left-behind children [ $(15.57 \pm 13.824)$  points], with a statistically significant difference ( $P < 0.05$ ). The average level of social anxiety among left-behind children [ $(2.88 \pm 0.942)$  points] is slightly higher than that of non-left-behind children [ $(2.78 \pm 0.959)$  points], with a statistically significant difference ( $P < 0.05$ ) between the two.

## 4 Discussion

This study focuses on the manifestation of gender differences in social anxiety and delves deeply into its possible influencing factors. Through a comprehensive analysis of existing literature, the results indicate that gender differences may be influenced by a combination of sociocultural factors<sup>[17]</sup> and physiological changes<sup>[18]</sup>.

Firstly, sociocultural factors may occupy an important position herein. In different cultural contexts, society generally sets higher behavioral norms and expectations for women, particularly in handling interpersonal relationships. As pointed out by Zhang Guangzhen *et al.*, women are often encouraged to exhibit more cooperative and compliant behaviors during socialization, and this cultural discipline leads women to pay more attention to others' evaluations of them in social situations, thereby making them more prone to high levels of social anxiety<sup>[17]</sup>.

Secondly, the physiological changes during adolescence also impact the emergence of gender differences. Mesce M's research reveals that adolescent girls have a higher degree of concern for their body image, and negative body image is significantly associated with social anxiety, which may lead girls to more easily experience anxiety in social situations<sup>[18]</sup>. Meanwhile, lower exercise time and amounts of physical activity have a negative impact on individuals' physical and mental health<sup>[19]</sup>.

Although gender differences in social anxiety are significantly influenced by sociocultural and physiological factors, the differences in group characteristics cannot be ignored either. For instance, within the category of family environment, left-behind children and non-left-behind children exhibit different levels of social anxiety.

Left-behind children have higher anxiety levels than non-left-behind children, which is consistent with previous research findings<sup>[20]</sup>. Studies have shown that the mental health level of China's left-behind children significantly lags behind that of non-left-behind children. Among them, social anxiety disorder has become one of the most prominent and severe issues among rural left-behind children<sup>[21]</sup>. The higher level of social anxiety among left-be-

hind children may be related to their lack of stable family support<sup>[22]</sup>. The family is an important source of emotional support for children. When facing difficulties and setbacks in life, most non-left-behind children will first confide in their parents and seek help, whereas left-behind children, who are separated from their parents for long periods, only a small proportion will call their parents to talk about their troubles, and more often endure them silently or confide in classmates and friends, but often fail to obtain effective solutions, leading to greater anxiety and helplessness in social interactions. This lack of emotional support can make left-behind children exhibit more anxiety and unease in interpersonal interactions. Therefore, compared with non-left-behind children, left-behind children may be at a disadvantage in learning interpersonal skills<sup>[23-24]</sup>.

Due to the lack of daily social skills guidance and practical opportunities from their families, they may encounter more difficulties in getting along with peers, communicating and collaborating, which can lead to social anxiety<sup>[25]</sup>. In school-organized activities, non-left-behind children can quickly clarify tasks and divide labor and cooperate, while left-behind children often require more time to adapt and integrate, and perform more passively and unskillfully in communication and coordination, affecting the development of their social skills<sup>[26]</sup>.

Left-behind children often feel prejudice and unfair treatment from those around them due to their parents' long-term absence<sup>[27]</sup>, which leads them to develop biases in self-cognition<sup>[28]</sup> and become prone to feelings of inferiority and sensitivity<sup>[29]</sup>. For example, in class activities, some left-behind children may not dare to actively participate for fear of being ridiculed. When interacting with others, they will excessively care about others' opinions, and worry that their words and actions will not be accepted, thereby generating higher social anxiety.

## 5 Conclusions and suggestions

This study focuses on the junior high school student population, aiming to explore the impact of physical exercise on their social anxiety. Physical exercise has a significant effect on reducing middle school students' psychological anxiety levels, and physical exercise intervention methods are feasible. Different projects, frequencies, and durations of physical exercise have variability, and they differently impact middle school students' social anxiety. Therefore, middle school students should select corresponding physical exercise projects based on their own circumstances, and society, schools, and families should all strive to create a more scientific and reasonable physical exercise environment for middle school students.

In summary, this study provides government departments, society, schools, and families with first-hand data on the physical exercise and social anxiety situations of primary and middle schools in Yunfu City. It also provides theoretical basis and data support in areas such as intervening in psychological anxiety, improving mid-

dle school students' self-management and regulation abilities of psychological anxiety, and helping middle school students develop good physical exercise habits.

**5.1 Deepening the mechanism of collaborative education by physical education** It should accelerate the supply-side structural reform of school physical education, and create a trinity collaborative education mechanism of "school – family – community" from the perspective of the integration of sports and health. Using online and offline teaching forms as bridges and channels, physical health education as the content, it effectively connects schools with families and communities, thereby enhancing the effectiveness of collaborative education among schools, families, and communities, and achieving high-quality development of physical education in primary and middle schools. Firstly, it should strengthen the foundational role of family physical education. Families are the first teachers of adolescents. Parents should establish correct values regarding physical education, not only valuing the worth of sports but also leading by example and teaching through their own actions. Secondly, it should strengthen the dominant role of school physical education. Schools should hire outstanding athletes to teach in schools through purchasing services to improve the quality of school physical health education. Education departments and administrative departments should uniformly formulate a third-party access mechanism and actively promote cooperation between schools and off-campus sports training institutions and youth sports clubs through fiscal subsidies and preferential tax policies to achieve co-education. Thirdly, it should strengthen society's collaborative participation in physical education responsibilities and increase the reserve of social venues and human resources. Communities, as the main venue for students to carry out off-campus physical activities, must provide sufficient physical exercise resources. On the one hand, community sports should be incorporated into urban planning, designing professional and targeted physical exercise facilities for adolescents and increasing opportunities for adolescents to participate in off-campus sports activities. On the other hand, by organizing community sports practices, community sports health education should be broadened through events, activities, and other forms, and health education and infectious disease prevention knowledge could be popularized. It should leverage community sports education's auxiliary role in achieving the integration of sports and medicine, and sports and health, helping adolescents develop good exercise and lifestyle habits<sup>[30]</sup>.

**5.2 Paying attention to the cultivation of social and emotional abilities of left-behind children** Schools should strive to create and provide more opportunities for left-behind children to fully participate in collective activities<sup>[31]</sup>. On the one hand, it is necessary to regularly carry out carefully planned activities, and ensure that these activities not only accurately meet the actual needs of left-behind children but also effectively promote their positive interactions and exchanges with other students. Furthermore, activities must possess a high degree of inclusivity. When designing

collective activities, it is essential to fully consider the needs of all students, and ensure that the content and form of the activities are friendly and approachable for left-behind children, allowing them to participate freely in a relaxed and stress-free environment.

On the other hand, collective activity plans should be tailored according to the interests and abilities of left-behind children, helping them fully exert their strengths in the activities. Based on different needs, school administrators and teachers should carefully design personalized participation methods for left-behind children, such as arranging special sports activities for students with dyskinesia and organizing group activities for students with social barriers. When necessary, the rules of collective activities should also be flexibly adjusted to better suit the actual participation of left-behind children, enabling them to better integrate into collective activities and obtain more growth and development opportunities.

**5.3 Promoting the development of students' social and emotional abilities through physical exercise** The physical education and health curriculum in primary and middle schools is one of the important intervention methods to promote the physical and mental development of children and adolescents. Its ultimate goal is to cultivate students' correct values, essential character, and key abilities for future social adaptation. Based on achieving motor skill learning, sports participation experience, and health management application, individuals need to explore personalized social adaptation. Firstly, individuals should deepen their understanding of the relationship between physical exercise and social adaptation. Children and adolescents are in a critical period of social adaptation ability development. Physical exercise can meet their social adaptation needs for psychological and physical development; conversely, the physical exercise of children and adolescents whose psychological and physical social practices are not met will also be inhibited. Secondly, it should consciously explore social adaptation in physical exercise. Social adaptation ultimately refers to individual adaptation, closely related to individual personality and social environment. Therefore, individuals need to explore personalized physical exercise programs for social adaptation based on mastering the core competencies of physical education, such as mastering certain motor skills, participating in specific sports, and focusing on which aspects of health management, *etc.*, and consciously expand their social adaptation abilities. Through theoretical understanding and practice of subjective initiative, individuals can ultimately develop social adaptation abilities that fit their future development<sup>[32]</sup>.

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