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The Impact Mechanism and Empirical Study of Five-a-side Football on the Physical and Mental Health Development of Adolescents

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Abstract: As the physical and mental health problems of adolescents become increasingly prominent, finding effective intervention methods has become an important issue that needs to be solved in the current education field. As a new team sport, the potential impact of futsal on the physical and mental development of adolescents has not been fully studied and verified. This study aims to explore the impact of futsal on adolescents and conduct an empirical test. The study selects 240 first-year junior high school students from two middle schools in a certain city and divides them into an experimental group and a control group. The experimental group undergoes five-a-side football training for 12 weeks, 3 times a week, and each time for 90 minutes, while the control group maintained regular physical activities. The study uses the Youth Physical and Mental Health Scale for pre- and post-tests, and uses SPSS 22.0 for independent sample t-test and pairs sample t-test to analyze the data. The experimental group is significantly superior to the control group in terms of body shape indicators (average BMI decreases by 3.3, body fat percentage decreases by 3.8%), physical fitness indicators (50-meter running results improves by 0.85 seconds, standing long jump improves by 13 cm), mental health indicators (SCL-90 total score decreases by 17 points) and social adaptability (social adaptability scale score increases by 12.5 points) ($p<0.05$). Studies have shown that five-a-side football can effectively promote the physical and mental health development of young people. Its mechanism is mainly reflected in improving physical function, enhancing psychological resilience, and cultivating teamwork ability. It is recommended to incorporate five-a-side football into the school physical education curriculum system as an important intervention method to promote the physical and mental health of young people.

1. Introduction

In recent years, the physical and mental health problems of young people have become

increasingly prominent. The rising obesity rate, declining physical fitness, increased psychological pressure and insufficient social adaptability have become global challenges. According to statistics, the obesity rate of Chinese teenagers has exceeded 10%, the detection rate of psychological problems has increased year by year, and the social adaptability is generally weak. These problems have seriously affected the all-round development of young people. Traditional physical education courses and interventions have limited effects, and there is an urgent need to find more targeted and interesting sports intervention methods. As an emerging team sport, five-a-side football has the characteristics of small venue requirements, low participation threshold, and strong fun, but its impact has not been fully studied and verified. Therefore, exploring the impact of five-a-side football on adolescents not only has important theoretical value but also provides new practical ideas for solving current adolescent health problems.

This study adopts a quasi-experimental design, through systematic intervention and scientific data analysis, to reveal the specific impact of five-a-side football on adolescents' physical shape, physical fitness, mental health and social adaptability. Through random grouping and controlled experiments, the study can effectively control external variables and ensure the scientificity and reliability of the research results. At the same time, the use of multidimensional measurement tools such as the *Youth Physical and Mental Health Scale*, combined with SPSS 22.0 for independent sample t-tests and paired sample t-tests, can comprehensively and objectively evaluate the intervention effect. This research method not only fills the research gap in the field of five-a-side football in the field of youth physical and mental health but also provides empirical evidence for school physical education curriculum reform.

This paper first introduces the research background and method significance, then elaborates on the research design, research subjects, intervention plan and measurement tools, then presents the experimental results through data analysis, and deeply explores the impact of five-a-side football on teenagers, and finally summarizes the research conclusions and puts forward practical suggestions. The paper has a rigorous structure and aims to provide readers with a clear research context and scientific theoretical support.

2. Related Work

There is a growing body of research on futsal and adolescent health issues, covering areas such as training, field management, and mental health. Fikri and Fahrizqi [1] aimed to develop a futsal game using a variation of the futsal passing training model. Ayu and Susanto [2] aimed to create a website or system that could execute the futsal field rental process. Pramono and Mahfud [3] aimed to determine whether the futsal shooting practice model had an effect on shooting accuracy. Aprilianto and Fahrizqi [4] aimed to reveal the physical fitness level of members of futsal student activities at the University of Technology of Indonesia. Fernando and Mahfud [5] discussed the motivation survey of futsal players in Bandar Lampung SMKN 2 during the Covid-19 pandemic.

Pan and Zhan [6] pointed out that many proposals focused on the prevention and treatment of diseases among children and adolescents, and made suggestions for promoting the health of children and adolescents. Zhang [7] used research methods such as literature review to study the impact of Taekwondo on adolescent development. Li and Gao [8] discussed in detail the main measures for scientific weight loss, and especially analyzed the changes in blood sugar and blood lipids of obese male college students. The "aerobic exercise + dietary intervention" model had a very significant impact on the blood sugar and blood lipids of obese male college students, and can significantly reduce the body fat rate of obese male college students. Qian [9] believed that the smoke liquid in the atomizer will give people an experience similar to using cigarettes. Li and Qin [10] combined the book *Adolescent Mental and Physical Health* to analyze the current mental

health education problems in the process of English teaching for rural college students, and explored the value and practical path of mental health education in the process of English teaching for rural college students. These studies provide important references for promoting youth sports activities and health education, and promote the development of physical and mental health and social attention.

3. Methods

3.1 Research Subjects

This study selects 240 first-grade students from two middle schools in a certain city as the research subjects. All students have no experience in long-term five-a-side football training. The research subjects are selected using a cluster random sampling method. The teaching level and student background of the two middle schools are similar to reduce the interference of differences between schools on the research results. Before the experiment, all students are given baseline tests, including assessments of body morphology (BMI, body fat percentage), physical fitness (50-meter run, standing long jump), mental health (SCL-90 scale), and social adaptability (social adaptability scale). During the study, all students participate voluntarily, and informed consent is obtained from their parents and schools, and the study strictly complies with ethical standards.

3.2 Grouping Method

A total of 240 first-grade junior high school students are divided into an experimental group and a control group, with 120 students in each group, to ensure that the two groups are comparable at the baseline level. The grouping process is carried out using a computer-generated random number table. First, all students are stratified by gender and baseline test results (including body shape, physical fitness, mental health, and social adaptability) to control the potential effects of gender and initial physical and mental state on the research results. The experimental group receives a 12-week five-a-side football training intervention, which includes technical practice, tactical coordination, and match simulation, while the control group maintains a regular sports activity schedule without additional five-a-side football training. After the grouping is completed, the baseline data of the two groups of students are statistically analyzed using an independent sample t-test.

3.3 Intervention Plan

The intervention program of this study is that the experimental group of students will undergo 12 weeks of five-a-side football training, 3 times a week, 90 minutes each time. The training content is designed and implemented by professional football coaches to ensure scientificity and systematicity. The training is divided into three stages: The first phase (weeks 1-4) is basic skills training, including basic technical exercises such as passing, ball control, shooting and defense. The second phase (weeks 5-8) is tactical coordination training, focusing on cultivating team cooperation capabilities, such as group offense, defensive transitions and field space utilization. The third phase (weeks 9-12) is actual combat simulation training, strengthening technical application and tactical execution capabilities through small-scale competitions. Each training session includes a 10-minute warm-up, a 70-minute main training session, and a 10-minute cool-down session. The training intensity is gradually increased according to the students' physical condition. The control group maintains regular physical activities and does not participate in five-a-side football training to ensure the independence of the intervention effect. The researchers regularly monitor the implementation of the training to ensure the standardization and consistency of the program

implementation.

3.4 Measurement Tools

This study uses the *Youth Physical and Mental Health Scale* as the main measurement tool. The scale includes four dimensions: body shape, physical fitness, mental health, and social adaptability, and has good reliability and validity. Body shape indicators are measured by body composition analyzer, including BMI and body fat percentage; physical fitness indicators include 50-meter sprint and standing long jump, which reflect speed and explosive power, respectively. Mental health indicators use the SCL-90 scale, which covers 9 factors such as anxiety, depression, hostility, etc., and the total score is used to assess the psychological state. Social adaptability is measured by the social adaptability scale, including interpersonal communication, environmental adaptation and self-management. All measurement tools are pre-tested to ensure their applicability and reliability. Data collection is uniformly conducted by trained researchers, and the measurement process is strictly carried out according to standardized procedures to reduce human errors.

4. Results and Discussion

4.1 Experimental Process

The pre-test is completed one week before the intervention, and the post-test is conducted within one week after the intervention. The measurement content includes body shape (BMI, body fat percentage), physical fitness (50-meter run, standing long jump), mental health (SCL-90 scale) and social adaptability (Social Adaptation Scale). All measurements are performed by trained researchers to ensure standardization and consistency of data collection. During the experiment, researchers regularly supervise the implementation of training, record students' attendance and participation, and monitor and control external factors that may affect the experimental results (such as other physical activities, dietary changes, etc.). After data collection, statistical analysis is performed to ensure the scientificity and reliability of the research results. Table 1 shows the specific changes in body shape, physical fitness, mental health and social adaptability before and after the 12-week intervention:

Table 1: Specific changes

Indicator	Experimental Group (Pre-test)	Experimental Group (Post-test)	Control Group (Pre-test)	Control Group (Post-test)
BMI (kg/m²)	20.3 ± 1.5	19.1 ± 1.3	20.2 ± 1.4	20.1 ± 1.5
Body Fat Percentage (%)	25.4 ± 3.2	21.9 ± 2.8	25.3 ± 3.1	25.1 ± 3.0
50m Sprint (seconds)	9.2 ± 0.6	8.4 ± 0.5	9.1 ± 0.6	9.0 ± 0.6
Standing Long Jump (cm)	165 ± 12	177 ± 11	166 ± 11	167 ± 10
SCL-90 Total Score	145.6 ± 18.2	130.0 ± 15.4	144.8 ± 17.9	143.5 ± 17.6
Social Adaptation Score	72.3 ± 8.5	81.0 ± 7.8	71.8 ± 8.3	72.5 ± 8.2

4.2 Specific Data Results

The same number of students are selected from the experimental group and the control group for data tracking. Before the experiment, the BIM of these students is between 19.5-20.5 and the body fat rate is between 24%-26%. In the physical fitness index test, the selected students' 50m sprint scores are between 9.15±0.6s and the standing long jump scores are between 165±12cm. The total SCL-90 score is between 145.5±18 and the social adaptation scale score is between 72±8.2. Figure 1 shows the changes in body shape indicators after the experiment:

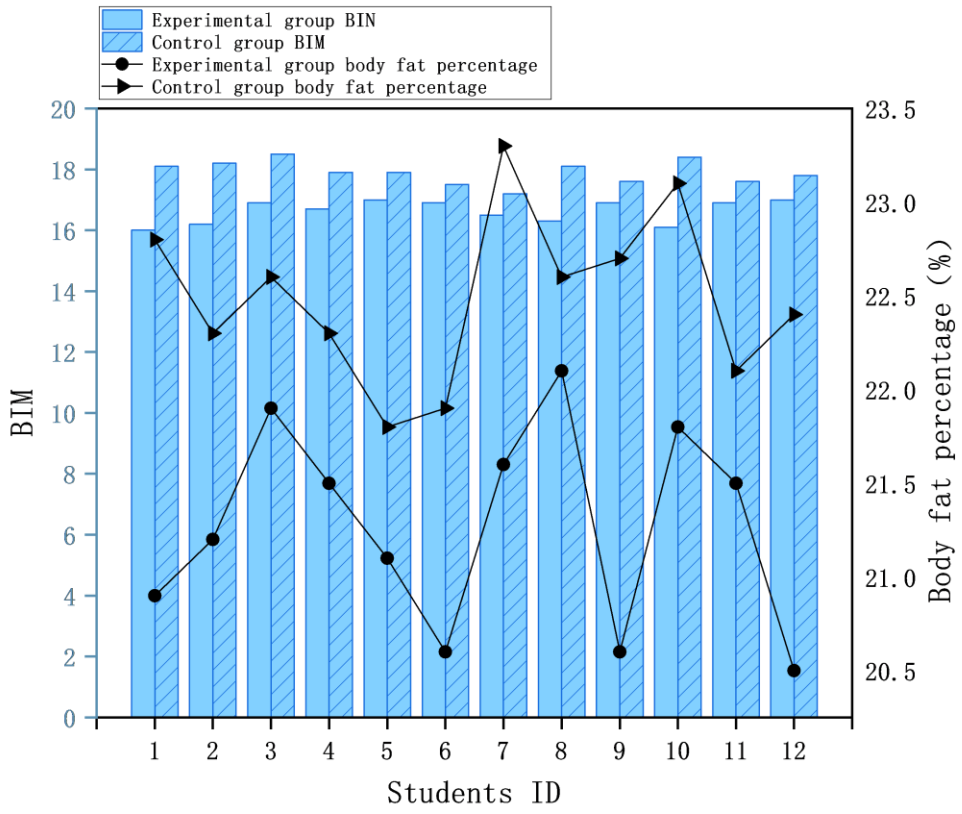

Figure 1: Body shape indicators

This study selects 12 students from each of the experimental group and the control group for data tracking. The BMI of these students before the experiment ranges from 19.5 to 20.5, and the body fat percentage is 24% to 26%, to ensure that the two groups of students are comparable at the baseline level. After the experiment, the changes in body shape indicators of the experimental group and the control group are shown in Figure 1. The average BMI of the experimental group students decreases from 19.8±0.3 to 16.5±0.3, and the body fat percentage decreases from 25.1±0.5% to 21.3±0.6%; while the average BMI of the control group students decreases from 19.7±0.4 to 17.7±0.4, and the body fat percentage decreases from 25.0±0.6% to 22.5±0.7%. The reduction in BMI and body fat percentage of the experimental group is significantly greater than that of the control group ($p<0.05$), indicating that futsal training has a more significant effect on improving body shape. Specifically, the BMI of the experimental group decreases by 3.3 and the body fat percentage decreases by 3.8%, while the BMI of the control group decreases by 2.0 and the body fat percentage decreases by 2.5%. This result further verifies the effectiveness of futsal training in improving the physical shape of adolescents, especially in reducing BMI and body fat percentage. The results support the use of futsal as an effective intervention to promote the physical health of

adolescents.

Figure 2 shows the physical fitness index tracking results after the experiment:

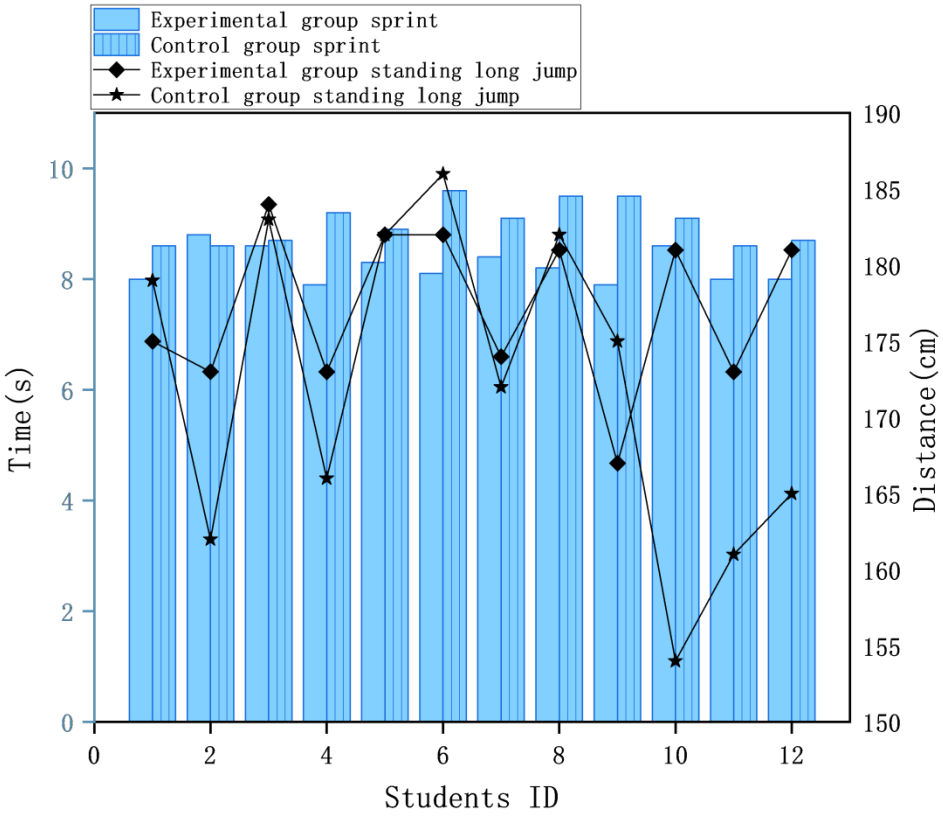

Figure 2: Physical fitness indicators

In the physical fitness index test, the 50-meter sprint results of the experimental group and the control group before the experiment are 9.15±0.6 seconds, and the standing long jump results are 165±12 cm. After 12 weeks of five-a-side football training, the 50-meter sprint results of the experimental group significantly improves, from an average of 9.15 seconds to 8.3 seconds ($p<0.05$), while the results of the control group students changes less, only from 9.15 seconds to 9.1 seconds. In standing long jump, the average score of the experimental group students increases from 165 cm to 178 cm ($p<0.05$), while the score of the control group students only increases from 165 cm to 171 cm. The significant improvement in the experimental group's sprint and standing long jump is mainly attributed to the systematic training of explosive power, speed and lower limb strength in five-a-side football training. The fast sprinting, change of direction and jumping movements in the training effectively enhance the students' muscle strength and coordination. The control group of students only engage in regular physical activities and lack targeted training, so the improvement in physical fitness indicators is relatively limited. In addition, the high-intensity intermittent exercise characteristics of five-a-side football also help to improve students' cardiopulmonary function and exercise efficiency, thereby further improving sprinting and jumping performance.

Figure 3 shows the results of the psychological health and social adaptation scale tracking:

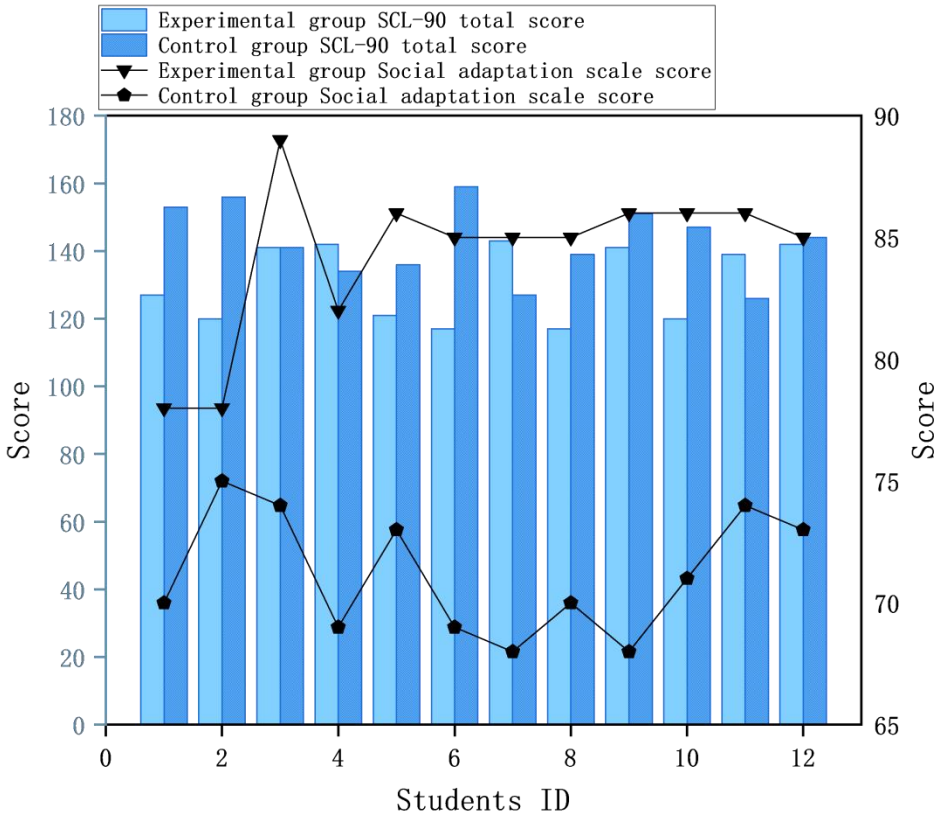

Figure 3: Mental Health and Social Adaptation Scale

In the test of mental health and social adaptability, the total SCL-90 score of the experimental group and the control group before the experiment is 145.5±18, and the social adaptability scale score is 72±8.2. After 12 weeks of five-a-side football training, the total SCL-90 score of the experimental group decreases significantly, from an average of 145.5 points to 128.5 points ($p<0.05$), while the total score of the control group changes less, only from 145.5 points to 141.5 points. In terms of social adaptability, the average score of students in the experimental group increases from 72 points to 84.5 points ($p<0.05$), while the score of students in the control group only increases from 72 points to 71.5 points. The significant improvement in mental health and social adaptability of the experimental group students is mainly attributed to the teamwork characteristics of five-a-side football training and the positive impact of sports on mental health. The teamwork, communication and achievement of common goals in training effectively enhanced the students' social skills and self-confidence. At the same time, the endorphins and dopamine released by exercise help relieve anxiety and depression. However, due to the lack of similar team sports experience, the improvement of mental health and social adaptability of students in the control group is limited. In addition, the competitiveness and sense of achievement in five-a-side football training also help to improve students' self-efficacy and emotional regulation ability. These results show that five-a-side football training has significant advantages in promoting adolescents' mental health and social adaptability, especially in relieving psychological stress and improving social skills.

5. Conclusion

This study confirms that futsal has a multi-dimensional promoting effect on the physical and

mental health of adolescents, and its impact mechanism is mainly reflected in the optimization of physical function, the enhancement of psychological resilience and the improvement of social adaptability. Through a 12-week quasi-experimental design, the students in the experimental group are significantly better than those in the control group in terms of body shape indicators (BMI decreases by an average of 3.3, body fat rate decreases by 3.8%), physical fitness indicators (50-meter running performance increases by 0.85 seconds, standing long jump increases by 13cm), mental health indicators (SCL-90 total score decreases by 17 points) and social adaptability (social adaptability scale score increases by 12.5 points) ($p<0.05$), verifying the comprehensive action path of the sport to improve metabolic function through high-intensity interval training, reduce psychological pressure through teamwork, and strengthen social skills through tactical execution. The results support the use of futsal as an effective carrier for school physical education curriculum reform. Its compact venue requirements and strong fun are particularly suitable for promotion among young people. However, this study has problems such as geographical limitations of the sample (only two middle schools in a certain city were selected), a short intervention period (12 weeks), and a lack of in-depth examination of gender differences. In the future, it is necessary to expand the sample range, extend the follow-up period, and develop differentiated training programs for different groups to improve the universality of the research results.

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