2024 Volume 2, Issue 2
Contemporary Education Frontiers
ISSN (Online): 3029-1860 ISSN (Print): 3029-1879

Association between Physical Activity and Physical Fitness Index among Children and Adolescents in Shaanxi Province

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Abstract:

With economic development and social progress, the lifestyle of children and adolescents has changed significantly, with excessive nutrient intake, sedentary behavior, and lack of physical activity affecting their physical fitness level and long-term health. A total of 2,013 children and adolescents aged between 7 to 18 years old were selected by stratified cluster random sampling method in Shaanxi Province. The changes in physical activity level, physical fitness index (PFI), and related body composition were analyzed. The results showed that the body mass index (BMI) and waist circumference (WC) of children and adolescents increased with age, and there were significant differences between boys and girls. Urban children and adolescents spend more time on physical activity than rural children and adolescents. This study is expected to provide theoretical support and practical guidance for improving the health status of children and adolescents.

Keywords:

Children
Adolescents
Physical activity

Online publication: December 16, 2024

1. Introduction

With the rapid pace of modern life, a series of public health issues have emerged, such as overnutrition and prolonged sitting, leading to a rise in abnormal body composition among children and adolescents in China. Notably, the prevalence of overweight and obesity has increased significantly, becoming a major health concern [1]. Being overweight or obese can lead to a decline in the physical fitness levels of children and adolescents and may even harm their health in adulthood [2]. According to a previous study, between 1985 and 2009, the overweight rate among Chinese children and adolescents rose from

1.11% to 9.62%, while the obesity rate increased from 0.13% to 4.95% [3].

According to the 2010 National Physical Fitness and Health Census, only 22.7% of students met the recommended amount of physical activity of one hour per day. The percentage of adolescents who met the recommended amount of physical activity was 32.7% for 9 to 13 years old, 20.7% for 13 to 16 years old, and 12.5% for 16 to 19 years old, respectively. The level of physical activity in adolescents has decreased gradually [4]. The 2014 National Physical Fitness and Health found that the physical activity level of adolescents showed a downward trend with the increase of age [5]. A 2018 World Health Organization study based on 1.6 million students aged 11 to 17 years old found that globally, more than 80% of school-aged children and adolescents do not meet the daily requirement of at least one hour of physical activity per day.

Physical fitness index is an important basis for evaluating physical health, which can comprehensively and objectively reflect the physical status and physical health level of children and adolescents. Based on previous studies, this research conducted tracking tests on the physical activity levels and physical fitness indices of children and adolescents. The measured physical activity data were used to evaluate their activity levels, aiming to comprehensively understand the correlation between physical activity and physical fitness. This study provides a theoretical basis for improving the physical health of children and adolescents in Shaanxi Province.

2. Results and analysis

2.1. Characteristics of BMI changes with age in children and adolescents

In both boys and girls, BMI increased from 16.13 kg/m² at age 7 to 23.77 kg/m² at age 18, with a standard deviation of 3.16 at age 7 and 3.21 at age 18. It can be seen that the difference in BMI gradually expands, which is mainly related to the difference in the growth rate of adolescent individuals during this period [6]. Some boys have entered the peak of their development, while others are in the slow stages of development, so the BMI fluctuates greatly.

For girls, the mean BMI was 16.42 kg/m² at 7 years old, 20.09 kg/m² at 18 years old, and the standard deviation was 3.60 at 7 years old, which then dropped to 2.54 at 18 years old. The narrowing of the BMI gap in girls after the age of 16 years old is due to the stability of girls' physical development after puberty. After the age of 13, the increase in BMI is primarily due to substantial acceleration in body fat gain.

2.2. Characteristics of waist circumference changes with age in children and adolescents

Waist circumference (WC) was positively correlated with age in both boys and girls. In boys, the mean waist circumference increased from 53.04 cm to 72.62 cm between the ages of 7 and 18. Although the standard deviation of waist circumference fluctuated slightly across age groups, it overall increased slightly from 9.53 cm at age 7 to 9.04 cm at age 18 and remained relatively stable, ranging from 9 to 11 cm. It is worth noting that the growth rate of waist circumference in boys accelerates after the age of 13, especially during the period from 13 to 16 years old. Due to large individual differences in growth and development, changes in waist circumference were also more pronounced [7]. This change is highly correlated with the peak growth period, when boys' weight, height, bone, and muscle development are rapidly increasing, which leads to a significant increase in waist circumference.

The mean waist circumference (WC) of girls increased from 53.16 cm to 66.80 cm between the ages of 7 and 18. From ages 7 to 10, the increase in WC was gradual, rising from 53.16 cm to 61.15 cm. During this period, the standard deviation was relatively large, at 9.32 cm, 10.25 cm, 9.75 cm, and 10.08 cm, respectively. At age 16, the standard deviation of waist circumference decreased to 8.52 cm, lower than the 9.32 cm at age 7. This change reflects the body shape development in girls: from ages 7 to 10, girls underwent a period of rapid body shape change, marked by a significant increase in waist circumference, body fat, and skeletal development. However, after age 16, the growth rate of girls' waist circumference slowed as puberty ended.

2.3. Characteristics of time spent on daily physical activity among children and adolescents in different regions

The purpose of this study was to analyze the time spent on physical activity by urban and rural children and adolescents aged 7 to 18 and to better understand the differences and patterns in physical activity time between the two groups. There were differences in the selection of physical activity durations (< 30 minutes, 31 to 60 minutes, and > 61 minutes) among children and adolescents in different areas. Regarding the proportion of children and adolescents engaging in physical activity for less than 30 minutes, the proportion of urban children and adolescents under the age of ten decreased year by year [8].

In contrast, the proportion of time spent on physical activity among rural children and adolescents aged seven to nine was relatively high. The study found that the proportion of physical activity time for rural children aged seven to eight was 53.33% and 46.88%, while for urban children, it was 46.67% and 42.50%, respectively. Rural children and adolescents were more likely to engage in physical activity for less than 30 minutes, which may be related to factors such as the rural living environment, available activity space, and family support.

In terms of the proportion of physical activity (PA) time between 31 and 60 minutes, the trends for urban and rural children and adolescents were similar. The proportion of physical activity increased in urban children and adolescents after the age of 12, reaching 40.00% at age 12 and 24.07% at age 18. However, the proportion of rural children in the same age group changed little and remained high, at 25.58% at age 18. Urban children and adolescents tended to have more regular physical activity schedules, which may be closely related to better sports facilities and greater opportunities for extracurricular activities in urban areas. Urban adolescents have more opportunities to participate in extracurricular physical activities and access advanced sports facilities in schools and communities, which increases their likelihood of engaging in longer durations of physical activity.

In terms of the proportion of physical activity time exceeding 61 minutes, the proportion of urban children participating in physical activity for this duration gradually increased with age, particularly among children and adolescents over 12 years old. Specifically, at age 16, the proportion of urban children and adolescents was 11.73%. In contrast, the proportion of rural children and adolescents in this regard is lower. Although there is an increase between the ages of 13 and 14, the overall level remains lower than that of urban children. The relative scarcity of resources and facilities in rural areas, along with fewer types of physical activities and opportunities, is one of the main reasons.

3. Conclusion and recommendations

3.1. Conclusion

The difference in BMI between boys and girls was small at the age of six to ten but increased rapidly with the onset of puberty in girls at the age of 11 to 13. The increase of WC in boys was obvious from 13 to 16 years old. However, for girls, WC increased sharply from seven to ten years old and gradually became stable with the end of adolescence. Urban children and adolescents were more likely to engage in longer and more regular physical activities due to more abundant physical resources and opportunities, while rural children were more likely to participate in short-term physical activities and less likely to participate in long-term physical activities.

3.2. Recommendations

Strengthening physical fitness monitoring and providing individualized interventions for children and adolescents to promote healthy growth is essential. We should also enhance the development of sports facilities and promote physical activity for children and adolescents in rural areas to narrow the gap between urban and rural areas. More attention should be paid to the changes in body shape of children and adolescents aged seven to ten and 13 to 16, with a focus on weight management and waist circumference to reduce the risk of obesity.

Funding

Scientific Research Program Funded by Shaanxi Provincial Education Department (Program No. 23JK0434).

Disclosure statement

The authors declare no conflict of interest.

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