

Research on the physical fitness changes of adolescents aged 13-15

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Abstract: By comparing and analyzing the statistical data of adolescents aged 13-15 selected from the three National Physical Fitness Monitoring Bulletins over the past decade, this study examines the physical fitness changes of adolescents in this age group from three main aspects: physical form, physical function, and physical quality. The results show that over the past 10 years, there has been a significant improvement in the physical form development of Chinese adolescents aged 13-15, with all related indicators showing marked increases. In terms of physical function development, there have also been improvements to varying degrees, especially in lung capacity, which has seen a substantial increase. Regarding physical quality, boys have shown improvement in speed quality, while girls have outperformed boys in the other three aspects of physical quality, with boys experiencing varying degrees of decline in these areas.

Keywords: Adolescents Aged 13-15, Physical Fitness Monitoring, Growth

1. Introduction

This study conducts an in-depth analysis of the data from three National Physical Fitness Monitoring Bulletins over the past decade to explore the trends in the physical fitness of adolescents aged 13-15. The research examines changes in key indicators such as height, weight, chest circumference, lung capacity, 50-meter sprint, standing long jump, pull-ups (for boys)/sit-ups (for girls), and 1000-meter (for boys)/800-meter (for girls) endurance runs, focusing on three main aspects: physical form, physical function, and physical quality. The results indicate that with improvements in living standards and nutrition, adolescents have shown significant progress in physical development and function, particularly in lung capacity. However, disparities in physical quality development have emerged between genders, with girls outperforming boys, which may be attributed to boys' unhealthy lifestyle habits and lack of physical exercise. This study provides a scientific basis for understanding the changes in adolescents' physical fitness and offers insights for developing targeted health promotion strategies.

2. Research objects and methods

2.1. Research objects

The research objects were the physical fitness monitoring data of adolescents aged 13-15 extracted from three National Physical Fitness Monitoring Reports. These three sets of monitoring data involved adolescents from 31 provinces, municipalities directly under the central government, and autonomous regions across the country. The data were collected using a stratified random cluster sampling principle. The samples included 249,489 children and adolescents (students) aged 7-19 in 2005, 227,259 in 2010, and 308,725 in 2014, which ensured the representativeness of the data. [1-3]

2.2. Research methods

The research in this paper primarily employs a comparative analysis method. The physical form is analyzed from three dimensions: height, weight, and chest circumference. Physical function is mainly analyzed through resting heart rate and lung capacity. Physical quality is analyzed using four indicators:

50-meter dash, standing long jump, pull-ups (for boys), sit-ups (for girls), and 1000-meter run (for boys) / 800-meter run (for girls). Through these analyses, the trends in the physical fitness changes of adolescents aged 13-15 are examined.

3. Analysis results

3.1. Adolescents aged 13-15 show improved physical form

Table 1: Height, Weight, and Chest Circumference of Adolescents Aged 13-15 in Three Physical Fitness Monitoring Reports (1-31)

Gender	Year Age	Height (cm)			Weight (kg)			Chest Circumference (cm)		
		2005	2010	2014	2005	2010	2014	2005	2010	2014
Male	13	157.9	159.9	161.4	46.7	49.4	52	74.2	75.8	77.3
	14	163.7	165.3	166.5	51.6	53.8	56.2	77.3	78.7	79.9
	15	167.7	168.8	169.8	55.3	57.2	59.5	79.8	80.9	82

Table 1 (Continued): Height, Weight, and Chest Circumference of Adolescents Aged 13-15 in Three Physical Fitness Monitoring Reports [1-3]

Gender	Year Age	Height (cm)			Weight (kg)			Chest Circumference (cm)		
		2005	2010	2014	2005	2010	2014	2005	2010	2014
Female	13	154.9	156	157	44.7	46.2	48	74	75	76.3
	14	157	157.8	158.7	47.4	48.6	50.4	76.1	76.9	78.3
	15	158	159	159.4	49.4	50.1	51.6	77.6	78.1	79.1

As can be seen from Table 1, the data from the last two monitoring rounds show varying degrees of improvement in the three indicators for both boys and girls aged 13-15. Boys outperform girls in terms of height, weight, and chest circumference development. The height development is in line with the physical growth patterns of adolescents aged 13-15. However, weight and chest circumference development are generally expected to be more advanced in girls. Yet the data still show that boys outperform girls in these aspects. The following sections will analyze these findings separately.

Table 2: Changes in Height Data of Adolescents Aged 13-15 Based on the 2005 Physical Fitness Monitoring

Gender	Year Age	Height (cm)					
		2005	2010	Increase	2014	Increase	Growth Ratio (%)
Male	13	157.9	159.9	2	161.4	3.5	1.75
	14	163.7	165.3	1.6	166.5	2.8	1.75
	15	167.7	168.8	1.1	169.8	2.1	1.91
Female	13	154.9	156	1.1	157	2.1	1.91
	14	157	157.8	0.8	158.7	1.7	2.12
	15	158	159	1	159.4	1.4	1.4

As can be seen from Table 2, with the 2005 monitoring data as the baseline, the data from the 2010 and 2014 monitoring rounds show that the height of adolescents aged 13-15, both boys and girls, has increased to varying degrees. Except for the growth rate of 14-year-old girls in 2014, which exceeded 2%, the growth rates of boys and girls in other age groups were all below 2%. In the 13-14 age range, the height growth rate of boys was slightly lower than that of girls in the same age group. However, at age 15, the height growth rate of boys was significantly higher than that of girls in the same age group. Moreover, for both boys and

girls, the height growth rate decreased with increasing age. According to international definitions, the peak height growth for boys occurs at age 14, while for girls it occurs at age 12. The three sets of monitoring data also confirm this pattern.

Table 3: Changes in Weight Data of Adolescents Aged 13-15 Based on the 2005 Physical Fitness Monitoring

Gender	Year Age	Weight (kg)					
		2005	2010	Increase	2014	Increase	Growth Ratio (%)
Male	13	46.7	49.4	2.7	52	5.3	1.96
	14	51.6	53.8	2.2	56.2	4.6	2.09
	15	55.3	57.2	1.9	59.5	4.2	2.21
Female	13	44.7	46.2	1.5	48	3.3	2.2
	14	47.4	48.6	1.2	50.4	3	2.5
	15	49.4	50.1	0.7	51.6	2.2	3.14

As can be seen from Table 3, based on the 2005 physical fitness monitoring data, the data from the 2010 and 2014 monitoring rounds show that the weight of adolescents aged 13-15, both boys and girls, has increased to varying degrees. Except for the weight increase of 13-year-old boys in 2014, which was less than twice the weight increase in 2010, the weight increase of adolescents in other age groups in 2014 was more than twice that of 2010. This indicates that the weight of adolescents aged 13-15 is increasing too rapidly, leading to varying degrees of obesity. Particularly for 15-year-old girls, the weight growth ratio reached 3.14, which is significant as their bodies develop. The rapid weight increase for both boys and girls suggests that the physical development of adolescents is occurring earlier than expected.

For girls, this age range coincides with the normal developmental period, which is consistent with typical growth patterns. However, boys are generally expected to develop later. Despite this, the annual weight increase for boys is greater than that for girls, indicating a tendency towards obesity among boys.

Table 4: Changes in Chest Circumference Data of Adolescents Aged 13-15 Based on the 2005 Physical Fitness Monitoring

Gender	Year Age	Chest Circumference (cm)					
		2005	2010	Increase	2014	Increase	Growth Ratio (%)
Male	13	74.2	75.8	1.6	77.3	3.1	1.94
	14	77.3	78.7	1.4	79.9	2.6	1.86
	15	79.8	80.9	1.1	82	2.2	2
Female	13	74	75	1	76.3	2.3	2.3
	14	76.1	76.9	0.8	78.3	2.2	2.75
	15	77.6	78.1	0.5	79.1	1.5	3

As can be seen from Table 4, based on the 2005 monitoring data, the data from the 2010 and 2014 physical fitness monitoring rounds show that the chest circumference of adolescents aged 13-15, both boys and girls, has increased to varying degrees. For boys, the growth rate of chest circumference in all age groups in 2014 was close to 2%. In contrast, for girls, the growth rate of chest circumference was proportional to their age, which is a result of normal physical development. Similar to the situation with weight, the annual increase in chest circumference for boys was higher than that for girls, which does not conform to the normal pattern and similarly indicates a tendency towards obesity among boys.

3.2. Adolescents aged 13-15 show improved physical function, especially in increased lung capacity

Table 5: Resting Heart Rate and Lung Capacity in Three Physical Fitness Monitoring Reports of Adolescents Aged 13-15

Gender	Year Age	Resting Heart Rate (beats/min)			Lung Capacity (mL)		
		2005	2010	2014	2005	2010	2014
Male	13	83.4	83.1	83.2	2377	2477	2667.5
	14	82.5	81.8	82.5	2696.1	2830	3045
	15	81.6	80.7	81	3026.1	3164	3369
Female	13	84.3	83.5	83.6	1909.4	1996	2132.8
	14	83.6	82.8	83.2	2007.8	2109	2261.7
	15	82.8	81.7	82.3	2109.8	2208	2345.7

As can be seen from Table 5, for adolescents aged 13-15, there is no significant change in the resting heart rate across different age groups for both boys and girls; it only fluctuates slightly. However, there is a substantial difference in lung capacity, which has increased significantly across all age groups. For boys, lung capacity increases by approximately 300 mL each year with age, while for girls, it increases by about 100 mL each year, which is consistent with the normal patterns of growth and development.

However, compared to the 2005 data, the 2010 monitoring showed an increase of about 100 mL in lung capacity for both boys and girls in the same age groups. Compared to the 2010 data, the 2014 monitoring showed an increase of about 200 mL in lung capacity for boys and about 150 mL for girls in the same age groups. This indicates that there was a significant turning point in lung capacity improvement in the 2014 monitoring, with a notable increase.

3.3. Gender differences in physical fitness development among 13-15-year-olds

Table 6: Four Physical Fitness Indicators in Three Physical Fitness Monitoring Reports of Adolescents Aged 13-15

Gender	Year Age	50m(s)			Standing Long Jump (cm)		
		2005	2010	2014	2005	2010	2014
Male	13	8.7	8.6	8.5	187.4	188.5	185.6
	14	8.3	8.2	8.2	200.5	201.7	198.9
	15	7.9	8	7.9	211.6	213	212.2
Female	13	9.7	9.7	9.6	159.5	158.8	156.7
	14	9.7	9.7	9.6	160.7	160.8	159.5
	15	9.7	9.7	9.6	163	163.3	164.5

Table 6 (Continued): Four Physical Fitness Indicators in Three Physical Fitness Monitoring Reports of Adolescents Aged 13-15

Gender	Year Age	Pull-ups (for boys) / Sit-ups (for girls) (reps/min)			1000m (for boys) / 800m (for girls) (s)		
		2005	2010	2014	2005	2010	2014
Male	13	2.3	2.4	1.9	298.2	297.5	300.4
	14	2.9	3.1	2.7	284	281.9	281.8
	15	3.6	3.8	3.4	271.6	271.2	269.6
Female	13	27.2	26.2	28.9	268.7	269.3	266.5

	14	28.1	27.2	30.1	265.8	263.4	261.3
	15	29.1	28.3	31.4	261.5	259.9	257.6

The data in the continued table represent the indicators of strength and endurance. For strength, pull-ups were used for boys and sit-ups for girls. For endurance, boys ran 1000 meters and girls ran 800 meters.

As can be seen from the three monitoring rounds in Table 6, among adolescents aged 13-15, the physical quality of boys aged 13-14 in the 50-meter sprint showed varying degrees of improvement in both the 2010 and 2014 monitoring data. However, for 15-year-old boys in the 50-meter sprint, the 2010 performance decreased by 0.1 seconds, and the 2014 performance remained the same as in 2015. In the three categories of standing long jump, pull-ups, and 1000-meter run, the 2010 monitoring data were slightly higher than those in 2005, but the 2014 data showed varying degrees of decline.

For girls aged 13-15, the performance in sit-ups slightly decreased in 2010. Except for the slight decline in the standing long jump for girls aged 13-14 in 2014, the monitoring data from different years in other projects all showed varying degrees of improvement. Overall, there are differences in the physical quality of adolescents aged 13-15. Boys' overall performance tends to decline, while girls' overall performance tends to rise. This indicates that the improvement in girls' physical quality is generally better than that of boys.

4. Discussion of results

In the three monitoring reports, the physical development of adolescents aged 13-15 has shown varying degrees of improvement and continues to exhibit an upward trend. This is attributed to the rapid economic growth of our country between 2005 and 2014. During this period, social wealth increased significantly. The Gross Domestic Product (GDP) grew from 18.59 trillion yuan in 2005 to 40.89 trillion yuan in 2010, which is 2.22 times that of 2005. By 2014, it reached 63.59 trillion yuan, 3.42 times that of 2005 and an increase of 22.7 trillion yuan compared to 2010. In terms of income, the per capita net income of rural residents in China was 3,255 yuan in 2005, while the per capita disposable income of urban residents was 10,493 yuan. By 2010, these figures had risen to 5,919 yuan for rural residents and 19,109 yuan for urban residents. In 2014, the per capita disposable income of rural residents reached 10,489 yuan, and that of urban residents was 28,844 yuan [4]. The significant increase in disposable income has led to a substantial improvement in living standards, which in turn has ensured that adolescents receive adequate nutrition, thereby promoting their physical development. This is particularly evident in the increase in weight, which has grown at a noticeably faster rate than height and chest circumference. Overall, this aligns with the normal growth and development patterns of adolescents in the 13-15 age group. The lung capacity indicator has performed exceptionally well, with a significant increase observed in the 2014 monitoring report, marking a turning point.

According to the 2014 National Fitness Activity Survey, the number of times adolescents aged 13-15 participate in physical exercise each week has decreased. The primary reason they are reluctant to engage in exercise is the fear of "affecting their studies," which has led to a faster increase in weight and a higher likelihood of obesity [5].

Adolescents aged 13-15 are in the compulsory education stage, and most of their physical exercise is supervised by schools. There is little difference in the amount of physical exercise between boys and girls. Girls in this age group are in a rapid development phase. However, boys have a higher annual increase in weight and chest circumference compared to girls of the same age, which does not conform to the normal development patterns of adolescents in this age group. Surveys indicate that boys in this age group tend to consume more snacks and are significantly more sedentary than girls. These unhealthy lifestyle habits and behaviors contribute to the higher likelihood of obesity among boys compared to girls, resulting in varying degrees of decline in multiple physical fitness indicators. The only exception is the 50-meter sprint, where boys have shown some improvement. Overall, girls' physical fitness has improved more significantly than that of boys [6].

5. Conclusion

Through the comparative analysis of three sets of monitoring data over the past decade, adolescents aged 13-15 have shown varying degrees of improvement in physical development due to the improved living

standards and adequate nutrition supply. Their physical functions have also improved to different extents, with a significant increase in lung capacity. However, the development of physical fitness has shown different growth patterns, with girls outperforming boys. This is mainly due to boys' unhealthy lifestyle habits and patterns. Lack of physical exercise is the primary cause of obesity [7].

6. References

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