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Physical Fitness Development of Preschool Children in Chongqing: An Analysis of Tests in Different Region, Age and Gender

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Abstract: This study evaluated the physical development levels of preschool children across different districts of Chongqing, considering variations in age and gender, with the aim of proposing a differentiated physical education curriculum implementation plan tailored to the differences in age, gender, and physical fitness levels among this population. A total of 1209 preschool children (46.89% girls) aged 3–6 years were tested on eight items: height, weight, standing long jump, 10 m toss, seated forward bend, tennis ball toss, continuous jump on both feet and walking the balance beam. One-way variance, multiple comparisons and *t*-tests were used to calculate and express differences in their results. Overall, preschoolers (City) performed better than preschoolers (Country) in height and standing long jump, and preschoolers (Country) performed better than preschoolers (City) in continuous jumping on both feet. With the exception of the seated forward bend test, there were significant differences in the fitness levels of preschoolers by grade, with preschoolers of different genders (Boys) performing better than preschoolers (Girls) in height, weight, standing long jump and tennis throw. Preschoolers (Girls) performed better than preschoolers (Boys) in the 10 m toss and bend in a sitting position, and the gender differences were more pronounced with increasing age.

Keywords: Preschool children; Physical fitness; Athletic ability; Physical education

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1. Introduction

Obesity in childhood increases the risk of obesity in adulthood and causes a range of health problems [1]. The preschool years are a critical time for establishing healthy behaviors, intervening in overweight/obesity, motor development and basic motor skills [2–6]. It has been found through follow-up that higher levels of development of large muscle movements in early childhood are associated with better physical fitness in adolescence [7]. Higher levels of physical activity during this period are associated with important health benefits in the physical, emotional,

social and cognitive domains over their lifetime [8]. Physical fitness in preschool children is the combined level of motor ability, motor skills, physical ability and fitness in young children and includes many aspects of cardiorespiratory fitness, muscular strength, endurance, flexibility, agility and balance [9,10]. Better fitness levels in children are associated with health outcomes, and poor physical fitness is a risk factor for cardiovascular disease and poor mental health [11–13]. Physical fitness in preschool children can influence individual health outcomes later in life [14,15]. In addition, an environment with sufficient opportunities for physical activity leads to a significant increase in children's displacement motor skills [16]. Boys are more active than girls in early childhood and the availability of facilities, playgrounds, play spaces and teacher encouragement play an important role in the physical activity of young children [17]. Girls are at a disadvantage in terms of physical activity performance, and the development of physical activity promotion intervention strategies for young children needs to focus on gender differences [18]. During the preschool years, creating supportive environments and providing ample opportunities for physical activity to promote movement, develop motor skills, and enhance physical fitness is of critical evidence-based importance for preventing obesity, advancing gender equality, and achieving lifelong health benefits, the physical fitness of preschool children is influenced by age, gender, living environment, education and teaching, and can serve the purpose of diagnostic screening and disease prevention and detection of motor talent and provide a realistic basis for the reform of physical education and teaching activities for preschool children. Therefore, this study tests the physical fitness characteristics of children of different ages, genders and regions, and proposes targeted teaching strategies.

2. Methods and materials

2.1. Subjects

The data standards for this study refer to the China National Physical Fitness Test (Preschool Children Section) Standards [19]. Using stratified random group sampling, participants were selected from four districts in Chongqing; urban and rural were selected from each region, and classes were randomly selected from the selected kindergartens to recruit preschool children in good physical and mental health, with a total of 1,209 (46.89% girls) participating in the project. All participants joined voluntarily and were coded in Arabic numerals to avoid leakage of personal information.

2.2. Test items and plans

All items are tested by professional testers in accordance with the Chinese National Physical Fitness Test Standards (For Preschool Children). Familiarization with the testing environment and technical instruction are conducted before the items are tested, and the testing equipment is calibrated, and the items are tested at a relatively fixed time to avoid data errors caused by factors affecting physical fitness. The tests include height, weight, standing long jump, 10 m shuttle run, Sited forward bend, Tennis ball toss, Continuous jump on both feet and Balance beam walking. The test methods are shown in **Table 1**.

Table 1. The Chinese national physical fitness test standards (for preschool children)

Test project	Method	Test purpose
Height	The tester stands barefoot and in an upright position on the base of the height meter with the heels, sacrum and both scapulae in contact with the column of the height meter, head upright, eyes level in front of them and the upper edge of the ear screen level with the lowest point of the lower edge of the eye socket until the data has been read and the better percentile score is recorded.	Reflecting longitudinal skeletal growth
Weight	Testers should dress minimally, move gently when getting on and off the scale, stand naturally in the center of the scale until the data is read and the better percentile score is recorded.	Reflecting developmental and nutritional status
Standing Long Jump	The test taker stands with the feet naturally apart, swings the arms behind the starting line and jumps forward as far as possible with the feet on the ground, measuring the straight-line distance between the starting line and the nearest heel.	Reflecting lower limb strength
10m shuttle run	The test is conducted in groups of not less than two persons, starting from a standing position at the starting line, when the signal "run" is heard, run at full speed towards the folding line, the test subject runs to the folding point, touches the marker with his hand and then turns around and runs towards the target line, when his chest reaches the vertical surface of the starting and finishing line, the test is finished, the test is conducted twice, the better percentile score is recorded.	Reflecting agility
Sited forward bend	The tester sits on a cushion, legs straight, heels together, toes naturally apart, full foot pressed against the tester plate, then palms down, arms together and flat, upper body bent forward, using the middle fingertips of both hands to push the cursor smoothly forward until it cannot move; knees cannot be bent, no sudden forward movement, test twice, record the better percentile score.	Reflecting flexibility
Tennis ball toss	The tester's body faces the direction of throwing, stands with both feet apart, stands behind the technical throwing line about 50C away, holds the tennis ball with one hand above the head and throws it forward as far as possible; when throwing the ball, the back foot can take a step forward, but cannot step on or over the throwing line, the valid score is the straight line distance between the throwing line and the place where the ball lands, test twice, record the better percentile score.	Reflecting lower limb strength
Continuous jumping on both feet.	The testers stand with their feet together behind the starting line and jump with both feet at the same time, jumping over one or two soft squares with both feet, jumping over 10 soft squares in a row, test twice, and record the better percentile score.	Reflecting upper limb and waist and abdominal strength
Walking the balance beam.	The tester stands on the platform, facing the balance beam, and moves forward rapidly with arms raised sideways until either foot touches the finish line.	Reflecting balance

2.3. Data analysis

In this study, 1209 preschool children in Chongqing were tested, and eight indicators, including height, weight and sitting forward bend, were carried out for testing. The SPSS 25.0 statistical analysis software was used to compare the differences in the indicators, and the data were expressed as mean ± standard deviation ($\overline{x} \pm s$), and independent samples *t*-test was used to compare the differences between two groups; one-way ANOVA was used to compare the differences between the three groups, ANOVA test was used for chi-square and LSD method was used for multiple comparisons, and Welch's ANOVA test was used for non-chi-square and Games-Howell test for multiple comparisons, with a statistically significant difference of 0.05.The mean and standardized scores of each test item were used to represent the effect of differences in physical fitness levels of preschool children in Chongqing by region, age and gender.

3. Results

This study enrolled a total of 1,209 preschool children for testing, including Boys (n = 642) and Girls (n = 567); Urban (n = 637) and Country (n = 572); 3–4 Years (A1:n = 376),4–5 Years (A2:n = 342), and 5–6 Years (A3:n = 491). A Multiple comparisons analysis was conducted to examine preschool children across different age groups, genders, and regions, as detailed in **Table 2**.

Table 2. Analysis of the differences in physical fitness test results of preschool children of different ages, sex and regions in Chongqing

	Different regional groups				Different age groups						Different gender groups			
	City (n = 637)	Country (n = 572)	t	p	3–4 Year (A1:n = 376)	4–5 Year (A2:n = 342)	5–6 Year (A3:n = 491)	F	p	Multiple comparisons	Boys (n = 642)	Girls (n = 567)	t	p
Height	113.2 ± 8.62	111.89 ± 8.27	2.687	0.007 *	104.38 ± 5.68	111.71 ± 5.45	119.46 ± 5.67	773.564	< 0.001 *	A3 > A2 > A1	113.5 ± 8.24	111.54 ± 8.62	4.026	< 0.001
Weight	19.28 ± 3.62	19.34 ± 3.92	-0.243	0.808	16.62 ± 2.61	18.93 ± 3.1	21.63 ± 3.47	294.479^{w}	< 0.001 *	A3 > A2 > A1	19.81 ± 3.72	18.74 ± 3.74	4.978	< 0.001 *
Standing long jump	84.62 ± 27.33	82.07 ± 26.04	1.652	0.042 *	61.31 ± 22.86	84.64 ± 22.71	99.48 ± 19.25	339.987^{w}	< 0.001 *	A3 > A2 > A1	86.79 ± 27.59	79.59 ± 25.25	4.711	< 0.001 *
10 m shuttle run	8 ± 1.86	7.89 ± 1.64	1.097	0.273	9.33 ± 1.99	7.77 ± 1.16	7.01 ± 1.15	210.034^{w}	< 0.001 *	A3 > A2 >A1	7.77 ± 1.73	8.15 ± 1.77	-3.824	< 0.001 *
Seated forward bend	6.49 ± 3.98	6.48 ± 3.9	0.068	0.946	6.66 ± 3.68	6.31 ± 3.97	6.46 ± 4.12	0.719	0.487	/	5.35 ± 3.54	7.77 ± 3.98	-11.113	< 0.001 *
Tennis ball toss	5.02 ± 2.21	5.05 ± 2.92	-0.246	0.806	3.37 ± 1.31	4.7 ± 1.63	6.55 ± 2.94	248.572^{w}	< 0.001 *	A3 > A2 > A1	5.62 ± 2.78	4.37 ± 2.12	8.872	< 0.001 *
Continuous jump on both feet	7.65 ± 4.12	7.58 ± 4.48	0.301	0.012 *	10.74 ± 5.85	7.06 ± 2.71	5.62 ± 1.57	162.75^{w}	< 0.001 *	A3 > A2 > A1	7.51 ± 4.28	7.73 ± 4.31	-0.895	0.371
Walking the balance beam	13.68 ± 12.87	14.64 ± 14.48	-1.215	0.224	24.28 ± 16.61	12.11 ± 11.4	7.77 ± 6.01	177.651^{w}	< 0.001 *	A3 > A2 > A1	13.79 ± 13.79	14.52 ± 13.51	-0.93	0.352

Note: w indicates unevenness of variance using Welch's ANOVA test and the Games-Howell test for multiple comparisons.

Table 2 presents the means and standardized scores of height, weight, standing long jump, 10-meter shuttle run, sit-and-reach, tennis ball throw, two-foot continuous jump, and balance beam walking among preschool children across different regions, age groups, and genders. The analysis revealed the following patterns: Urban preschoolers performed better in height and standing long jump compared to their rural counterparts, while rural children achieved higher standardized scores in the two-foot continuous jump. No significant regional differences were observed in the remaining indicators; Significant differences were found among the three age groups (A1, A2, A3) in height, weight, standing long jump, 10-meter shuttle run, tennis ball throw, two-foot continuous jump, and balance beam walking. Multiple comparisons indicated that: Performance in height, weight, standing long jump, and tennis ball throw improved with age (A3 > A2 > A1); Differences existed among all three groups in the 10-meter shuttle run, two-foot continuous jump, and balance beam walking; No significant difference was observed in sit-and-reach across the age groups. With the exception of sit-and-reach, physical fitness levels generally increased with age, which is consistent with typical growth and development patterns in preschool children; Boys outperformed girls in height, weight, standing long jump, and tennis ball throw, whereas girls performed better in the 10-meter shuttle run and sit-and-reach. No significant gender differences were found in the remaining test items. Additionally, apart from height and weight, scores across all test items were generally low among preschool children from different regions, age groups, and genders, with sit-and-reach yielding the lowest scores overall. These findings provide an empirical basis for informing the development of physical education curriculum and teaching reforms for preschool children in Chongqing.

4. Discussion

This study uses representative Chinese testing standards and methods to reflect the physical fitness development levels and differences between preschool children of different regions, ages and genders in Chongqing, and can be used as a reference basis for physical education curriculum and teaching reform, disease prevention and physical fitness screening for preschool children. This study observed that preschoolers (City) performed better than preschoolers (Country) in terms of overall fitness level, and that preschoolers in group A3 performed better than preschoolers in group A1 in all items tested, except sitting forward bend, indicating a positive correlation between age and physical fitness, in line with national and international studies [20]. Preschoolers (Boys) outperformed preschoolers (females) on all fitness tests except for the double-legged jump and the balance beam, again demonstrating that preschoolers (Boys) outperformed preschoolers (Girls) in strength and speed, with boys scoring higher than girls on object manipulation [21]. Consistent with the view that boys generally have better object control than girls and that there are significant gender differences [22,23]. The greater gender difference in explosive power in the upper and lower limbs is consistent with the view that there is less gender difference in trunk extensor flexibility and speed [24]. In contrast, preschoolers (Girls) performed better in flexibility than preschoolers (Boys), consistent with previous studies and in line with gender-differentiated growth and development. Therefore, a differentiated approach is needed to design the content of physical education curriculum activities for preschool children based on urban and rural teaching environments, age, gender and fitness levels. In addition, the level of physical development of preschool children in Chongqing is not high. It is recommended that preschool children (Country) emphasize a balanced diet and focus on nutrition and scientific exercise, and that preschool children (City) actively participate in outdoor physical activities such as climbing and jumping. Childhood is a critical period for the development of motor skills and the acquisition of motor skills and physical activity [25]. The focus should be on

strength and speed, balance and flexibility development, promoting skeletal growth in preschool children and preventing obesity. It is recommended that teaching should be differentiated according to gender, with preschoolers (Girls) focusing on developing upper and lower limb strength and mobility development, and preschoolers (Boys) focusing on coordination and flexibility quality development. Finally, the measurement and assessment of preschool children's physical development is dominated by gross and large muscle movements and upper and lower limb strength measures internationally. E.g. German MOT4–6, American PDMS-2 and TGMD-3, Canadian BOT-MP-2, British MABC-2, Netherlands. China mainly adopts a unified standard test that places more emphasis on the comprehensive development of young children's physical and mental health and physical fitness, and there are significant differences in the way preschool children are measured in China and abroad.

5. Conclusion

The overall physical development level of preschool children in Chongqing requires improvement, with notable variations across regions, age groups, and genders. It is recommended that Chongqing's preschool physical education curriculum reform and health promotion initiatives fully consider and address these group-specific differences to provide more targeted and scientifically grounded interventions and support.

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The authors declare no conflict of interest.

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