



# Health-related physical fitness levels of Turkish kindergarten children: a three-year follow up

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[Ergun N, Bayrakçı Tunay V, Baltacı G. Health-related physical fitness levels of Turkish kindergarten children: a three-year follow up. Fizyoter Rehabil. 2006;17(3):120-126.]

## Research Report

**Purpose:** The purpose of this study was to assess health-related physical fitness levels of Turkish kindergarten children and to show the differences of age and gender. **Material and methods:** Sixteen kindergarten children were evaluated through 3 years from the beginning age of  $34.62 \pm 5.6$  months in this study. Health-related physical fitness tests were done in the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> years. Each child completed a battery of health-related physical fitness tests including skinfold thickness for body composition, sit ups and pull-ups for muscular strength and endurance, sit and reach test for flexibility, standing broad jump test for power, flamingo test for balance, and 10-meter running for speed and coordination. **Results:** Statistically significant improvements were seen in tests through years in all children ( $p < 0.05$ ) except for the sit-ups test ( $p > 0.05$ ). Girls had better results in flexibility and balance tests ( $p < 0.05$ ). **Conclusion:** Girls have better results in flexibility in all ages compared to boys, and physical fitness levels increase across ages in Turkish kindergarten children.

**Key words:** Kindergarten, Physical fitness, Age, Gender.

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## Türk yuva çocuklarının sağlıkla ilgili fiziksel uygunluk seviyeleri: 3 yıllık takip

**Amaç:** Bu çalışmanın amacı Türk yuva çocuklarının sağlıkla ilgili fiziksel uygunluk seviyelerini değerlendirmek ve yaş ve cinsiyet farklılıklarını göstermekti. **Gereç ve yöntem:** Bu çalışmada, başlangıç yaşı  $34.62 \pm 5.6$  ay olan olan 16 yuva çocuğu 3 yıl boyunca değerlendirildi. Sağlıkla ilgili fiziksel uygunluk testleri 1., 2. ve 3. yıllarda yapıldı. Her çocuk; vücut kompozisyonu için skinfold kalınlığı, kassal kuvvet ve endurans için sit-ups ve pull-ups testleri, esneklik için oturuzan testi, güç için ayakta öne atlama testi, denge için flamingo testi, hız ve koordinasyon için 10 metre koşu testini içeren sağlıkla ilgili fiziksel uygunluk test bataryasını tamamladı. **Sonuçlar:** Tüm çocuklarda, yıllar içinde, sit-ups testleri hariç ( $p > 0.05$ ) diğer testlerde istatistiksel olarak anlamlı gelişmeler görüldü ( $p < 0.05$ ). Kızlar esneklik ve denge testlerinde daha iyi sonuçlara sahipti ( $p < 0.05$ ). **Tartışma:** Kızlar erkeklere göre esneklik testlerinde daha başarılıdır. Türk yuva çocuklarında fiziksel uygunluk seviyeleri yaşla birlikte artış göstermektedir.

**Anahtar kelimeler:** Yuva çocukları, Fiziksel uygunluk, Yaş, Cinsiyet.

Physical activity has positive effects on growth and maturation in children and improves cardiovascular fitness, and builds muscular endurance and strength.<sup>1,2</sup> It is very important for parents and teachers to encourage children to be physically active and join to the sport activities. In this way, boys and girls have an opportunity to make friends, to have fun, and to enhance health and well-being.<sup>1</sup> There are numbers of different assessment techniques that have been used to assess physical activity and fitness status of different groups. Some of them have been developed specifically for children.<sup>3</sup> The purpose of doing physical fitness tests is not only to obtain or reach maximal performance, but also to reach fitness for health and good health status. Encouraging children into a sustainable active life style should influence adult levels of heart disease and stroke in the future.<sup>4,5</sup> Regular physical activity and life style can influence physical fitness from childhood through adulthood.<sup>6-8</sup> Physical activity and well designed physical education programs provide children with both current and future health benefits at the same time.<sup>9-13</sup>

Recently there has been increased interest in the physical activity and fitness levels of children.<sup>14</sup> Physical activity rates decline with children age, and boys are typically more active than girls across all age levels.<sup>15</sup> Youth fitness programs should focus on age-appropriate activities that give all participants an opportunity to play, make friends and improve their fitness level.<sup>16</sup>

The purpose of this study is to evaluate health-related physical fitness levels and sex differences of Turkish Kindergarten children at the ages of 3, 4 and 5 years.

## Material and Methods

Sixteen kindergarten children were evaluated through 3 years from the age of 34.6±5.6 months in this study. They were recruited on a volunteer basis from their preschool. Children's height, body weight, and body mass index (BMI) differences through 3 years were shown in Table 1, and age differences were shown in Table 2. Height and body weight were measured in school clothing with shoes removed before the fitness tests. BMI was calculated through the formula of BMI=weight in kilograms/height in meters<sup>2</sup>.

Each child completed a battery of health-related physical fitness tests adapted from EUROFIT test batteries. Children were individually administered following test items:

- Skinfold thickness was measured from three sites; subscapularis, triceps and umbilicus with Lange caliper (Cambridge Scientific Industries, Cambridge, MA) from the right side of the body according to the guidelines of Lohman and Allsen et al used to estimate body fat.<sup>17,18</sup>
- The number of sit ups attained in 1 minute, which tested both abdominal strength and endurance, and pull ups for both arm strength and endurance.<sup>19</sup>
- Sit and reach test which measured lower back flexibility by the furthest distance reached.<sup>19</sup>
- Standing broad jump test (SBJ) (as far as a child can jump from a standing start) which assessed the strength of the lower body and legs.<sup>19</sup>
- Flamingo balance test which tested the duration of standing in an upright position on one leg.<sup>19</sup>

**Table 1. Physical characteristics of all children through years.**

	1st year X±SD	2nd year X±SD	3rd year X±SD	
<b>Age (month)</b>	34.6±5.6			
<b>Height (cm)</b>	104.5±14.8	107.6±4.8	116.3±6.1	*
<b>Body weight (kg)</b>	16.8±2.3	19.1±2.5	21.9±3.0	*
<b>Body mass index (kg/m<sup>2</sup>)</b>	16.3±1.4	16.4±1.1	16.5±1.6	*

\* p<0.05.

**Table 2. Physical characteristics of girls (N=8) and boys (N=8) through years.**

		1st year X±SD	2nd year X±SD	3rd year X±SD	
<b>Age (month)</b>	<i>Girls</i>	35.8±3.8	46.3±7.2	58.3±7.2	*
	<i>Boys</i>	33.5±4.0	45.5±4.0	57.5±4.0	*
<b>Height (cm)</b>	<i>Girls</i>	104.8±3.2	111.0±4.0	118.8±4.2	*
	<i>Boys</i>	103.5±4.0	112.3±4.0	120.6±3.3	*
<b>Body weight (kg)</b>	<i>Girls</i>	17.2±1.2	19.1±1.9	20.3±1.8	*
	<i>Boys</i>	18.6±2.5	20.5±3.1	23.4±2.8	*

\* p<0.05.

• The 10-meter run, which measured speed and coordination according to the time a child took to run as fast as possible 10-meter distance. The reduced distance was selected for administration to the younger children.<sup>19</sup>

SBJ and sit and reach tests were repeated 3 times in order to minimize error. The methods of fitness tests contributing to this report have been described previously in the literature.<sup>18-21</sup> We divided the results of each fitness test based on the age and gender of the children. Tests-retests were conducted at the same time near the end of the preschool year in June. Tests were performed by the same group and at the same time of the day. Means and standard deviations were used for physical characteristics. The data were analyzed with repeated measures of variance for analyze

changing in tests through years. Statistical significance was set at p<0.05.

## Results

Through 3 years follow up, statistically significant improvements were seen in all tests (p<0.05) except sit-ups test (p>0.05) (Table 3). In the 1<sup>st</sup> and 3<sup>rd</sup> year, girls have better results in sit and reach test but in the 2<sup>nd</sup> year no statistically differences were found between boys and girls. Balance test results were found better in girls in the 3<sup>rd</sup> year (p<0.05) (Table 4). Figure 1, 2, and 3 show Sit & Reach and Standing broad jump tests (cm), Pull-ups and Sit-ups tests (rep/min), 10-meter run and Flamingo balance tests (sec) results through 3 years.

**Table 3. Fitness test results of all children (N=16).**

	1st year X±SD	2nd year X±SD	3rd year X±SD	
<b>Sit &amp; Reach (cm)</b>	10.0±4.0	15.0±4.4	20.6±11.32	*
<b>Pull-ups (rep/min)</b>	8.4±3	15.2±4.6	19.3±6.0	*
<b>Sit-ups (rep/min)</b>	12.6±32.9	12.3±3.8	12.6±6.6	
<b>Standing broad jump (cm)</b>	58.5±17.9	75.4±20.1	86.2±13.4	*
<b>10-meter run (sec)</b>	11.1±1.8	7.3±1.5	4.3±0.5	*
<b>Flamingo balance (sec)</b>	7.1±4.6	7.9±2.9	8.5±4.8	*
<b>Skinfold measures (mm)</b>				
<i>Umbilicus</i>	5.9±2.2	5.8±3.4	5.0±3.2	*
<i>Triceps</i>	10.1±4.8	9.3±3.1	4.2±1.5	*
<i>Subscapularis</i>	5.9±2.1	4.6±1.9	4.2±1.5	*

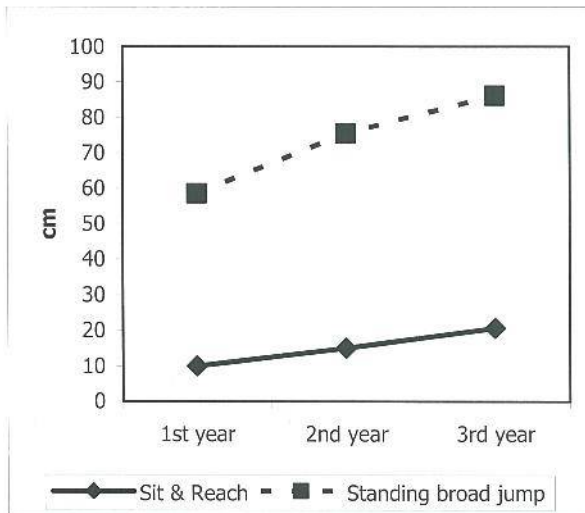
\* Between 1st, 2nd, and 3rd years, p<0.05.

**Table 4. Fitness test results of girls (N=8) and boys (N=8).**

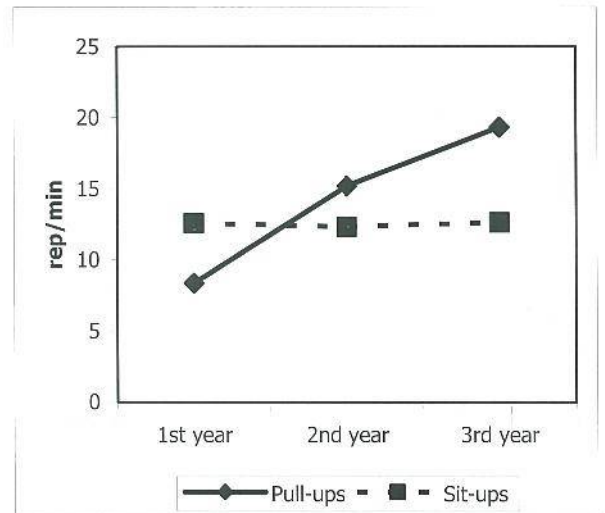
		1st year X±SD	2nd year X±SD	3rd year X±SD		
<b>Sit &amp; Reach (cm) †</b>	<i>Girls</i>	11.6±2.4	15.1±4.3	24.9±14.1	*	
	<i>Boys</i>	8.4±4.7	14.9±4.4	16.4±8.6	*	
<b>Pull-ups (rep/min)</b>	<i>Girls</i>	8.9±2.9	14.6±4.2	19.4±9.5	*	
	<i>Boys</i>	7.9±3.0	15.8±5.0	19.3±3.1	*	
<b>Sit-ups (rep/min)</b>	<i>Girls</i>	13.3±3.2	11.8±3.4	13.5±9.2		
	<i>Boys</i>	11.9±2.7	12.9±4.4	11.8±4.0		
<b>Standing broad jump (cm)</b>	<i>Girls</i>	56.3±19.3	69.0±23.9	81.1±14.9	*	
	<i>Boys</i>	60.8±16.5	81.9±16.2	91.3±11.2	*	
<b>10-meter run (sec)</b>	<i>Girls</i>	11.9±1.8	7.6±1.5	4.4±0.5	*	
	<i>Boys</i>	10.3±1.8	7.0±1.5	4.2±0.5	*	
<b>Flamingo balance (sec) ‡</b>	<i>Girls</i>	7.5±4.8	8.3±4.1	9.3±4.1	*	
	<i>Boys</i>	6.8±4.3	7.6±1.8	7.7±5.4	*	
<b>Skinfold measures (mm)</b>	<i>Umbilicus</i>	<i>Girls</i>	6.1±1.8	5.8±3.6	5.1±3.7	*
		<i>Boys</i>	5.6±2.8	5.9±5.3	4.9±2.8	*
	<i>Triceps</i>	<i>Girls</i>	10.3±4.0	9.5±2.7	4.4±2.0	*
		<i>Boys</i>	10.0±5.4	9.0±3.6	4.1±1.0	*
	<i>Subscapularis</i>	<i>Girls</i>	5.1±1.7	4.5±1.6	4.4±2.0	*
		<i>Boys</i>	6.6±2.4	4.8±2.3	4.1±1.0	*

\* Between 1st, 2nd, and 3rd years, p<0.05.  
 †In the 1<sup>st</sup> and 3<sup>rd</sup> years, girls better than boys (p<0.05). ‡ In the 3<sup>rd</sup> year, girls better than boys (p<0.05).

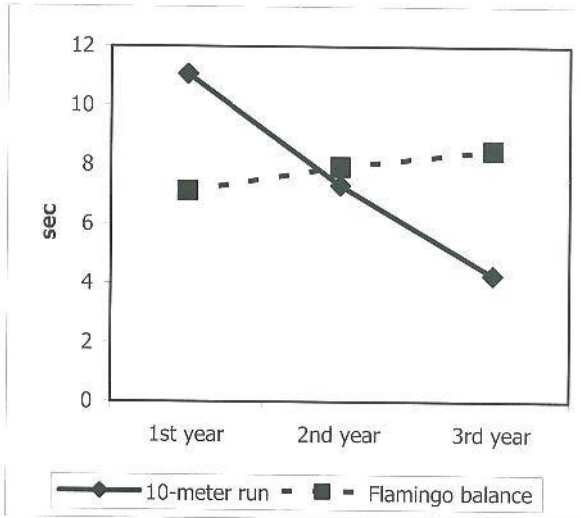
**Figure 1. Sit & Reach and Standing broad jump tests (cm) results of the children.**



**Figure 2. Pull-ups and Sit-ups tests (rep/min) results of the children.**



**Figure 3. 10-meter run and Flamingo balance tests (sec) results of the children.**



## Discussion

Physical fitness tests modified from EUROFIT tests were designed to be an observational system that was easy to practice and reliable to show the fitness differences between ages and genders. In kindergarten children, selecting at least one appropriate test in each component of fitness is vital when measuring health status.

According to Morris et al, improvements in balancing skill as early as ages 3 and 4 years, balance test was not sensitive enough to detect them.<sup>22</sup> In our study, girls have better results than boys, and similar to Morris et al, significant differences were found in 3 years of follow up.

A lot of studies have demonstrated that body composition is a factor that affects performance of various measures of physical fitness and motor performance.<sup>20,21,23</sup> Body structure has generally been found to have a significant relationship to physical performance.<sup>24</sup> The results of Reeves et al indicated that 1/2-mile run performance was significantly correlated with body weight and relative body fat, showing that as body weight or relative body fat increased run performance times were slower.<sup>23</sup> Our results showed that higher levels of BMI were directly related to the poorer fitness test results according to 3 years of follow

up. These findings were in agreement with the results reported by Chen et al.<sup>21</sup> Their batteries of fitness tests included an 800/1600 m run/walk, a standing long jump, bent leg curl-ups and sit and reach test, and the results showed that 43% of the students tested better than poor, 14.9% of the students all test performance was better than fair, only 2.6% of the students achieved an excellent performance in all four tests.<sup>21</sup>

The 1 mile run/walk test was used to index aerobic fitness. This test is recommended for children in kindergarten through fourth grades (5 to 10 year olds). The 1 mile run/walk test has been shown to have good interclass reliability for both boys and girls in grades 3 and 4. Tucker et al showed concurrent validity for the run/walk test in their study, given 1 mile times were related significantly to the child physical activity scale, body fat percentage, and BMI.<sup>25</sup> Because of children's lower ages, we did not evaluate aerobic and aerobic power in our study. We used a 10-meter run test for testing speed. Speed increased during 3-year follow up, and boys results were found better than girls according to the test results.

Baldauf determined that muscle strength increases 1/3 ratio every year between 3-7 ages. Other factors those effects muscle strength are muscle cross sectional area, muscle fiber diameter, muscle cell number, and differences in body parts with age.<sup>26</sup> According to the pull ups and sit ups tests results of our study, pull-ups results increased while ages of the children increased. Boys had better results than girls in pull-ups test, and girls had better results than boys in sit-ups test through the years.

Flexibility increased with years, and girls had better results in 3 years follow up. This was similar to the results of Baquet et al.<sup>10</sup> They found better results in flexibility test of girls than boys.

Our study showed similar results according to the study of Duger et al, they determined that standing broad jump motor ability showed linear increase with age.<sup>27</sup>

Meredith and Dwyer, worked in school children and reported that motor performance of the children can be improved with age, and boys have better performance in all age groups according to girls.<sup>28</sup>

There are few studies about the physical fitness status of 3-4 years old children. Morris et al studied on the gross motor movements of children ages between 3-6 years and they showed that the real efficiency is age.<sup>22</sup> They found significant differences in throwing distance, running speed, and standing broad jump tests in the favor of boys in 3-5 year old children.<sup>22</sup> Sex difference is accepted one of the most important factor, and longitudinal studies showed differences between sex and fitness scores.<sup>11</sup> At the same time, age and sex determine characteristics of movement performance.<sup>29,30</sup>

Our results showed that higher results of fitness tests were directly related with growing. However, we can not provide a proper health-related physical fitness level profile of Turkish kindergarten children with 16 children but the result of this study can provide some information about Turkish kindergarten children and can help in designing the sport and activity programs.

## Conclusion

A battery of tests with various aspects of health-related physical fitness was conducted on Turkish kindergarten children. Although the number of the children included in this study was low because of difficulty in the assessment of same children through 3 years, we hope that these data will be considered in future criterion referenced to 3 to 5 years old Turkish kindergarten children physical fitness standards. Future research needs to examine factors contribute to age/sex, body composition and other differences in physical fitness levels of Turkish kindergarten children with increased sample size. Additionally, the relationships between physical fitness levels, health status, and physical activity levels of kindergarten children need to be studied further.

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