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Comparision of strenght speed and endurance in 11-13 age boys and girls

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Abstract

The aim of this study was to evaluate the differences among strength, speed and endurance in 11-13 age girls and boys and development of these biomotor abilities according to age. Totally 305 children have joined this study. Height, weight, standing broad jump, 20 m. Sprint run, 15 s crunch test, 10 s. Push-up test, 20m. Shuttle Run tests (Eurofit Tests batteries) have been measured. The differences obtained from the test results between girls and boys who joined the study have been analysed. In both groups at age of 11 and 13 significant differences were found between all parameters ($p<0,05$). Between weight and standing broad jump, 15 s crunch test significant differences were found on children at age of 12.

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Keywords: Children; Strength; Speed; Endurance

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1. Introduction

Despite the continuous deceleration experienced in the child growth during the first years of primary school education, secondary gender characteristics and an instant increase in body height are observed to emerge in girls due to the changes in the physical biochemicals at around the age of ten. While boys have taller and bigger bodies than girls until the age of ten, they appear to look smaller than girls around the final years of the primary school education.

However, they are more active than girls and they prefer activities that require physical strength more than girls do. Motor skills are observed to improve in both genders more than they improve in the preschool period. Primary school children can easily run and climb. Skills such as roller skating and biking could easily be attained during this period. Physical growth and improvement that relatively decelerates during childhood, accelerates during adolescence and reaches its final structure for adulthood following this period (Erden and Akman, 1995).

In the event that a healthy child is deprived of physical activities and is restrained from sufficient activity, his/her psychomotor development would be damaged and his/her performance at school would decrease accordingly. A study that was conducted in France reveals one of the most significant examples on this issue. In the study that was conducted in Vanve near Paris, students enrolled in the baccalaureate program were divided into two groups and the number of hours allocated to theoretical courses was decreased for one group while the existing schedule was sustained in the other group. The number of hours allocated to physical education and sports was increased in the group, whose number of hours allocated to theoretical courses was decreased and the students performed sports activities in various fields of sports. According to the evaluations made at the end of the year, it was observed that while the achievement rate in the group that followed the existing schedule was 60%, the achievement rate of the group with increased sports hours increased to 89% (Cited by Kalyon, 1994). It is not possible to interpret the relationship between sports and achievement completely; however, the following opinion is hypothesized:

Those who begin to adapt physical performance to a certain type of sport at a young age and those who have extraordinary skills could reach the highest level of athletic performance. Athletic skills should be identified as early as possible and they should be improved thereafter. Precise and reliable values of physical competence would guide educators and politicians about the measures to be taken in this field (Açıkada and Ergen, 1990).

Physical competence has two dimensions: health and performance. While the performance dimension referred to the topics such as strength and speed, the health dimension covers endurance and body composition (Demirel et al., 1990).

Muscle power increases as the children grow. During adolescence, there are certain increases in the muscle strength. In the fields of sports that depend on muscle strength and speed, improvement occurs slowly as age level increases. Therefore, putting too much pressure on children in the early years for achievement purposes could have negative effects on their physical development (Kalyon, 1994).

This study aimed to analyze whether there were any differences in girls and boys aged between 11 and 13, in terms of explosive power, speed, and endurance, as well as the changes experienced according to their age levels.

2. Method

1.1. Subjects

The sampling of the study was composed of 305 students: 50 boys and 53 girls at the age of 11; 45 boys and 35 girls at the age of 12; and 62 boys and 60 girls at the age of 13. The height and body weights of the participants are listed in Table 1, together with their means and standard deviations

Table 1. Means and standart deviations of height and weight of study group.

	BOYS			GIRLS		
Age Group	n	Height (cm)	Weight (kg)	n	Height (cm)	Weight (kg)

11	50	145,01±5,4	39.7±6,2	53	149.01±6,2	38.05±5,03
12	45	150±7.1	41.9±9,02	35	152±8,7	39.6±6,5
13	62	157±8.5	45.5/±8,0	60	154.3±5,2	42.9±6,7

The sampling of the study was enrolled in the physical education courses according to the curriculum identified by the Ministry of National Education. Students who were certified athletes and were unable to perform sports due to certain reasons (post operation period, etc...), as well as those who were not able to participate in physical education classes due to a medical report were not included in the sampling.

1.2. Data Collection

The sampling was measured in terms of their height, weight, standing long jump, 20 second sprints, 15 second sit-up, 10 second push-up, and 20 meter progressive shuttle run values under the supervision of experienced assessors. All participants were measured in the indoor sports hall with synthetic turf floor without warming up. The endurance run and other assessments were executed on different days.

Height was measured with a "Sigma" branded tool with a mechanic height display (60cm - 200cm). The heights of the participants were measured barefoot with touching heels, in an upright standing position and after having taken a deep breath. The measurement was made twice, consecutively, and the best value was recorded.

Body weights were measured with a "Sigma" branded scale that measured the weight between 0 and 100 kilograms with a +500gr sensitivity, while the subjects were dressed in shorts and t-shirts. The participant was asked to look ahead while standing on the scale. The value identified was recorded.

For the standing long jump, the participant was asked to stand on a line 5 centimeters wide with the tip of his/her shoes on the line. The participant was asked to bend his/her knees and jump forward from this position. The participant was allowed to gain speed using his/her arms. In situations such as taking steps or line abuse, the jump was deemed invalid and the participant was asked to repeat. Those who failed twice were asked to perform the third assessment after the test was completed. The measured value was the distance between the jumping line and the point where the heels of the participant was located. In order to identify the jumping point where the heel was located, all shoe heels of the participants were marked with chalk.

The 20 meter sprint was performed within a 20 meters of distance was performed within a 20 meter distance marked with a strip and cones on the sides. While the observer with the chronometer stood at the finish point, another observer identified line abuse at the starting point. The run started with the "Ready... GO" command of the observer with the chronometer. The observer with the chronometer stood at the end of the strip, which was located at the finish point and stopped the chronometer when the participant passed the line. In the event of a false start, the test was repeated. For the participants who failed twice, the measurement was performed after the tests.

For the 15-second sit-up, the participant was asked to lie on the mat with his/her foot touching the floor, his/her knees bent 90 degrees, holding the hands behind the head touching each other. Participants' feet were held by an observer and the observer counted the sit-ups out loud. Starting position was when the back was angled 90 degrees to the floor. The observer holding the chronometer commanded, "Ready... Start" while turning on the chronometer at the same time and the participant began the sit-ups with the command. The measurement was completed when the participant stopped upon the "OK" command of the observer, indicating that the 15-second period was over. The value identified by the observer was recorded.

The 10 second push-up was performed by the participants lying down with the arms open at shoulder width, fingers and palms touching the ground facing forward. The starting position was when the participant was lying flat on the floor with his arms bent from the elbow joints, and the first push-up was counted when the chest touched the ground. The measurement began when the observer turned on the chronometer with the command, "Ready... Start" and the participant performed the push-up until the observer commanded "OK". The value mentioned by the other observer was recorded.

Progressive shuttle run was performed on a marked track of 20 meters and the participants ran along the track continuously. The rhythm of the run was synced with a signal broadcasted by a tape-recorder. The participant was allowed to approach the finish line within 2 meters and when s/he was 2 meters from the finish line, a warning was given. The test was finalized when the second warning was given. In the event that a participant was able to sync with the second signal while she had received one warning, the warning was erased. Participants, who did not receive any warnings, continued the test until they were sore. Five tracks were allocated for the test and two observers were located at the beginning and end of each track (Renson, 1993). The final appropriate value obtained by the participant was recorded.

1.3. Data Analysis

The differences between the test scores obtained by the participating girls and boys were analyzed in the SPSS 12.0 software through the t-test for independent groups. The differences between the age groups were observed through the single-dimensional ANOVA and Tukey tests.

3. Results

The values obtained from the participant girls and boys aged 11, 12, and 13 for their height, body weight, standing long jump, 20 meter sprint, 15 second sit-up, 10 second push-up and progressive shuttle run are given in Table 2, along with the arithmetic mean and standard deviations.

Table 2. Means, Standard Deviations and t-test values of variables of boys and girls in age groups

	11 age			**12 age**			**13 age**		
	BOYS	GIRLS	t-test	BOYS	GIRLS	t-test	BOYS	GIRLS	t-test
n	50	53		45	35		62	60	
Height (cm)	145±5,4	149±6,25	0.002*	150±7,1	152±8,7	0.499	157±8,05	154,3±5,29	0.026*
Weight (kg)	39,7±6,2	38,05±5,03	0.033*	41,9±9,02	39,6±6,5	0.156	45,5±8	42,9±6,71	0.059
Standing Long Jump (cm)	134,3±16,8	118,6±17,6	0.000*	144,9±33,5	132,5±19,89	0.078	155,9±20,5	137,4±15,73	0.000*
20 m Sprint (sn)	4,36±0,36	4,06±0,34	0.001*	4,48±0,45	4,87±0,41	0.000*	4,05±0,3	4,43±0,35	0.000*
15 s Crunch (rpt)	11,7±1,93	10,11±1,66	0.000*	10,76±2,36	10,03±2,21	0.239	12,59±2,14	10,5±2,36	0.000*
10 s Push up (rpt)	9,56±1,96	8,38±2,68	0.014*	6,23±2,88	4,75±2,33	0.008*	8,11±2,84	6,75±2,78	0.008*
Shuttle Run (tour)	29,24±11,02	24,4±8,88	0.018*	30,45±13,22	25,6±9,22	0.036*	43,31±16,96	28,46±11,43	0.000*

(*$p<0.05$)

According to the table, statistically significant differences were found between 11 age boys and girls in whole variables, on the other hand there were only statistical differences in 20m. sprint, 10 s. Push up and Shuttle run in 12 age boys and girls. While statistically significant differences were found between the 13-year-old boys and girls in terms of height, standing long jump, 20 meter sprint, 15 second sit-up, 10 second push-up, and progressive shuttle run ($p<0.05$), no statistically significant difference was found between their body weight values.

When same parameters evaluated in terms of gender, it was observed that the there was a linear increase in the body weights and heights of the boys and girls parallel to the increase in their ages.

In terms of height, statistically significant differences were observed for the boys at all ages ($p<0.05$). A statistically significant difference was observed for the girls in the 12-13 age group and the 11-13 age group, excluding those in the 12-13 age group ($p<0.05$).

In terms of the body weight, while there was a statistically significant difference in boys aged 11 and 12, there was no statistically significant difference between boys aged 12 and 13. Statistically significant differences were observed in the girls in the 11–13 age group and 12-13 age group ($p<0.05$).

As the indicator of explosive power, standing long jump values increased linearly in both genders according to age. The 20 meter sprint values, which were the indicators of speed skills decreased at the age of 12 for both genders.

With respect to the standing long jump, no significant difference was observed in the average scores of boys in the 11-12 age group, as well as those in the 12-13 age group; however, a statistically significant difference was found among the boys aged between 11 and 13 ($p<0.05$). According to the 20 meter sprint, while no significant difference was found in the 11-12 age group, significant differences were found in the 11-13 age group and 12-13 age group ($p<0.05$). The standing long jump values that were identified for girls resulted in no statistically significant difference, excluding those in the 12-13 age group. The 20 meter sprint values indicated a statistically significant difference for all age groups ($p<0.05$).

The 15 second sit-up values (muscular endurance in the stomach area) did not display any linear increase for both genders (Graph 3a). The 10 second push-up values (muscular endurance in the shoulder area) decreased towards the age of 12 and increased after that age.

With respect to the 15 minutes sit-up values, a statistically significant difference was observed for boys in the 12-13 age group ($p<0.05$). The 10 seconds push-up values concluded that there was a statistically significant difference at all age levels ($p<0.05$). While no significant difference was observed among girls with respect to the 15 second sit-up values, the average scores obtained from the 10 second push-up indicated a statistically significant difference in all age groups ($p<0.05$).

The progressive shuttle run (respiratory endurance) displayed a linear increase for both genders; however, there was a significant increase in boys when compared to the girls starting from the age of 12.

According to the average progressive shuttle run averages, a statistically significant difference was observed among the boys between the 11 - 13 and 12 - 13 age groups ($p<0.05$); however, there was no significant difference among the girls regarding this variable.

4. Discussion

Physical activity has invaluable effects on health, physical competence, as well as normal growth and development. A lack of exercise and extreme physical activity could be harmful within the growth and development process. Normal physical maturation represents the sequence of events experienced by all individuals, respectively. However, the starting points and formation speeds could vary. It is quite difficult to distinguish between the effects of regular physical activity on physical maturity as well as growth and maturation (Hills A., 1995).

While the period between the age of 11 and 13 referred to the transition period to the adolescence for girls in the sampling from school age, it refereed to the school age for boys. Girls experience adolescence in the 11 - 13 age group, while the boys experience adolescence in the 13 - 15 age group (Muratlı, 1992; Bağırgan, 1992; Erden and Akman, 1995; Zaichkowsky, 1980).

The deceleration in growth that starts in the preschool period continues until the ages of 10 and 11. Despite the continuous deceleration experienced in the child growth during the first years of primary school education, an instantaneous increase in body height is observed to emerge in girls due to the changes in the physical biochemicals around the age of ten. Although they appear smaller compared to girls, boys are more active (Erden and Akman, 1995). This information is in line with the conclusions of this study. The study concluded that 11-year-old girls were taller than the boys ($p<0.05$), that boys grew taller more quickly after the age of 12, and that at the age of 13 boys were taller than the girls ($p<0.05$).

In terms of height, 11-year-old boys were shorter than the girls; however they had higher values with respect to their body weights ($p<0.05$). No significant difference was found between girls and boys at the age of 12. In the 13-year-old age group, weight also increased in boys along with height; however, no significant difference was observed. Mechelen (1991) found that the height and body weights of girls in the 12 - 13 year-old age group were higher than those of the boys. In the crosscut study conducted with adolescent boys and girls in the 11 -17 age group

from Estonia and Lithuania, the changes in Eurofit performance were determined. In terms of body weight and gender, no significant difference was observed between the children of Lithuania and Estonia, who belonged to the 11 -13 age group; however, a significant difference was observed in Lithuanian and Estonian boys in terms of height (Jürimäe et al., 2007).

The linear increase in height, body weight, explosive power, and endurance values according to age is closely related to maturation. These parameters improve in a child within his/her daily life and game process without the need for a special study. However, speed requires special interest and genetic structure. It is easier to increase the speed for a child with a fast muscular genetic structure that belongs to the Type 2 tendons.

In his study, Keogh (1973) proved that the standing long jump values improved in the same manner in girls and boys until the age of 13, and the improvement accelerated in boys after the age of 13, while it remained the same for girls. The values covering the period between the ages of 11 and 13 are in line with the findings of this study. Muratlı (1992) suggested, "with respect to strength, boys reach the greatest strength improvement speed at the ages of 13 and 15. They have the lowest strength values at the age of 11; however, the girls at the same age have higher values". In both the current study and the study by Keogh, the standing long jump values were found to improve together until the age of 13 and girls were found not to have the same values as boys at the age of 11; on the contrary, boys were determined to have higher values. In this study, a statistically significant difference was found between the 11-year-old girls and boys with respect to the standing long jump values and the boys were observed to be able to jump further than the girls. Accordingly, the higher body weight averages determined in boys of this age group when compared to the girls indicates that the muscle bulk was larger in the boys. Standing vertical jump differences did not display a statistical significance in the 12-year-old age group; however, the difference was significant at the age of 13. In their study from 2007, Jürimäe et al. found that the standing long jump values in 11-year-old boys were 166.5±20.6 cm, and those values in girls were 157.5±20.2 cm. Standing long jump values in 12-year-old boys were 174.6±17.8 cm and they were 161.4±20.6 cm in girls. The same value was 182.4±22.1 cm in 13-year-old boys and 169.6±20.6 cm for girls.

Mechelen (1991) found that the height and body weights of girls in the 12 - 13 age group were higher than those of the boys. The endemic endurance in stomach muscles was found to be better in boys when compared to the girls due to the intense participation of boys in athletic activities outside the school when compared to the girls.

Boys at the age of 13 began to obtain better values than the girls of the same age group. Age 13 is the beginning of the adolescence period for boys. Starting with this age, boys experience improvement in maximum power, coordination, and gender characteristics.

According to the 20 meter sprint run, 11-year-old girls obtained better values than the boys ($p<0.05$), while in the 12-13 age group the values of boys were lower than the girls with a statistically significant difference. In their study, Sağlam et al. (2002) aimed to determine the physical competence and nutrition status of 127 students (68 boys, 59 girls) with the age average of 11.26±1.10 years. No statistically significant difference was found between the children who participated in sports and those that did not, excluding the variables of leg power. The 20 meter sprint values were 4.0±0.3 sec for the children who did not participate in sports, while the value was found to be 4.1± 0 sec for those who participated in sports activities. This shows that the values are close to the values obtained by the boys in this study; however, the difference was greater for the girls.

The development of body and arm muscles is known to improve the increasing athletic performance and protect the muscular skeleton system (Allen et al., 2013). The average scores obtained from the 15 second sit-up favored the boys in all age groups; however, the difference was statistically significant in only the 11 and 13 age groups. Additionally, the average repeated push-up scores obtained by the girls and boys in all age groups also favored the boys ($p<0.05$). Furthermore, an increasing curve was not observed due to the increasing age level. In their study, Jürimäe et al., determined the 30 second sit-up values in Estonian boys as 22.9±3.5 sit-ups, and in girls as 21.1±4.1 sit-ups. Twelve-year-old boys were found to perform 23.7±4.4 sit-ups and the girls were found to perform 21.2±3.8 sit-ups. The value determined for the 13-year-old boys was 24.5±3.7 sit-ups, and this was found to be 21.6±3.3 for the girls.

According to the study by Sağlam et al. (2002), the number of 20 seconds push-ups was found to be 37.5±11.3 in children who did not participate in sports, while the value was found to be 42.1±14.5 in children who participated in athletic activities. The standing long jump values for the same group were found to be 135.4±22.3 cm for the group who participated in sports activities and 129.2±16.5 cm for the group who did not.

The 20 meter progressive shuttle run values were found to be higher in boys in all three age groups and this difference was observed to be statistically significant at all age groups ($p<0.05$). In their study, Saygın et al. (2007) aimed to determine the effects of the movement training for 16 weeks on the physical competence parameters of the boys aged between 10 and 12, and they observed a significant difference in the treatment group while no significant difference was found in the control group. When the proportion of the heart volumes of a child and an adult to their body weights are compared, no significant difference was observed. Children and teenagers have a disadvantage, in terms of their oxygen reserves. Until the ages of 14 and 15, the amount of the blood component that transfers oxygen (hemoglobin) is lower than in adults. Even untrained children have quite high capacities of oxygen usage. However, they are not able to use this capacity effectively (Açıkada and Ergen, 1990).

5. Conclusion and recomendations

The aim of the sports courses in the curriculum is health education, movement education, game education, free-time education, and performance education (Cited by Koruç and Bayar, 1992). Physical education courses in Turkey are implemented according to the curriculum mandated by the Ministry of National Education. Paying special attention to the quality and importance of the physical education course content in such as manner as to improve the health and physical development of the children who do not actively participate in sports would ensure the academic achievement of healthy and fit individuals in the future.

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