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Investigation of physical performance parameters of children aged 12-14 years

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Abstract

This study aims to investigate the physical performance parameters and to determine the profiles of children aged 12-14 years and attending the secondary stage of public schools in Izmir province. The study included a total of 650 voluntary students (323 girls, and 327 boys) attending the 6th, 7th and 8th classes. Physical parameters of students were evaluated with tests selected from Fitnessgram, American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) and Eurofit Test Battery (Muscle Strength: hand grip strength, standing long jump; Muscle Resistance: pull-up; Flexibility: sit and reach test; Cardiovascular Endurance:1 mile running test (1609 m endurance running); Speed: 30 m sprint).

Statistical analysis of data was made by Two-Way Variance Analysis in SPSS 15.0 packet software, and Further Bonferroni analysis was used for age.

As a result of the study, performance parameters of children aged 12-14 years were determined to be lower than those reported by similar studies made on the same age group. Among the reasons, there are lack of physical activity, sedentary lifestyle, inadequate physical education and sport class and the reflections of education system.

Keywords: Adolescence, physical performance, Sport, Physical Fitness

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Introduction

When the term of motor is used alone, it means biologic and mechanic factors that affect the movement. Motor development is the way of muscle mechanism that enables the performance of motor skills to improve. And it is the voluntary act of organism in parallel to the development of physical growth and central nervous system.

Motor development in children and adolescents is directly related to the possible biologic development based on the calendar age. Mobility efficiency in various ages is directly related to the efficiency of muscle, central nervous system and circulation system. Motor properties develop at different development speed and independently of each other (Sevim, 1997).

The development of motor behaviors of children starts with quite easy reflexes and follows a course that results in highly coordinated motor skills. Movements of children progress in obtaining certain skills like reflexes, standing movements, walking, running and jumping. Motor development of all children follows a course from head to foot and from center to outward. Nervous system and muscle developments provide a basis necessary for obtaining motor skill.

Pubertal growth spurt (adolescent growth spurt) is one of the most important changes in adolescence. While there is little shape different between girls and boys in childhood, this difference gradually increases with pubertal growth spurt in adolescence (Gökmen, Karagül and Aşçı 1995).

Adolescence is a very critical phase in the continuum from childhood to adult maturity, and at the same time, the most important period of physical and mental development. In a sense, physical development in this period forms the basis of emotional and cognitive maturity. Therefore, optimal growth and development in this period means happy and healthy adulthood (Fu and Hao, 2002).

Changes in children caused by growth and development during adolescence should be followed and skilled children should be determined and brought in active sport. In this study, it was aimed to evaluate the performance parameters of students in secondary stage of primary education.

Methods

This study included a total of 650 students (323 girls and 327 boys) aged between 12-14 years and attending the secondary stage of public schools in Izmir province. Motor

performance parameters of students were evaluated with tests selected from Fitnessgram, American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) and Eurofit Test Battery (Muscle Strength: hand grip strength, standing long jump; Muscle Resistance: pull-up; Flexibility: sit and reach test; Cardiovascular Endurance:1 mile running test (1609 m endurance running); Speed: 30 m sprint).

Tests for determining the body composition, flexibility, muscle strength were performed in sports halls separated for physical education and sport class or in a closed space, while the 30 m sprint test and 1 mile run-walk test (1609 m) for determining the Cardiovascular Endurance were performed on flat and clean concrete ground in schoolyard in accordance with the Fitnessgram test protocol. Participants were composed of students who did not make sport except for attending the physical education and sport class.

The height of participants was measured by means of a measuring tape fixed on the wall. The results were recorded in information form as cm.

Body weight was measured with a Tefal trademark bathroom weighing machine with 0.01 kg of precision degree. The results were recorded in information form as kg.

Body Mass Index is calculated by dividing the weight by the square of the height.

Muscle strength of students was evaluated with a gripping force measured by a hand dynamometer. Gripping force was separately measured for right and left hands with Takei trademark TKK 5101Grip-D model hand dynamometer. Test was repeated twice with 30 second interval, and the higher score was recorded. Explosive strength of students was evaluated by standing long jump test.

30 second pull-up test was applied to measure the muscle endurance of participants (abdominal muscle endurance). After making necessary explanations about the test, students were allowed to perform the test once on control purpose. The number of pull-ups in 30 sec was recorded in information form.

Sit and reach test was employed to determine the flexibility of participants. Test was repeated twice and the higher number was recorded.

30 m sprint test was made on a previously measured flat asphalt floor of 30 m, and photocells with 0.01 of precision degree were placed at beginning and finishing lines, and the higher score of two trials made with rest interval was taken.

Cardiovascular endurance of students was determined with 1 mile run-walk test (1609 m). Students were asked to run the predetermined 1 mile distance (1609 m) as soon as

possible. Upon the start command, students were allowed to run, and the running time was recorded.

Data Collection

Necessary permissions were obtained before the study, and the test batteries applied to students during data collection were performed in the classrooms and schoolyards. Students were informed about each measurement tool and test procedure before the application of tests, and tools used in tests were presented and their motivation was provided. Participants were informed at least one week before the tests, and necessary information was obtained about their health conditions. Participants were not allowed for any warm-up movement before the test in accordance with the application procedures of test batteries. Study group was composed of students were not sportive, and did not participate in any physical activity except for physical education and sport class.

Data Analysis

Data obtained in the study were analyzed in Biostatistics and Medical Informatics Department of Medical Faculty of Ege University by using Statistical Package for the Social Sciences (SPSS) for Windows 15.0 packet software. The mean and standard deviation of data were calculated as descriptive statistics. Two-Way Variance Analysis and Further Bonferroni Analysis for age were used. 0.05 and 0.01 were chosen for significance level.

Results

Table 1. Results of Right Hand Gripping Strength Test concerning Age Groups of Female and Male Students

	FEMALE (n) X±Sd	**MALE (n) X±Sd**	**TOTAL (n) X±Sd**
12 Age	(89) 12.06±4.23	(83) 12.78±5.32	(172) 12.41±4.79
13 Age	(120) 14.94±4.89	(131) 16.64±6.19	(251) 15.83±5.67
14 Age	(114) 17,24±5,16	(113) 19,77±7,92	(227) 18,50±6,78
TOPLAM	(323) 14.74±4.76	(327) 16.39±6.47	(650) 15.58±5.74

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Considering right hand gripping strength, the difference between age groups was found statistically significant (12, 13 and 14 years of age) (F=1.223, P=.000). As a result of the multiple comparison test, statistically significant differences were detected between 12-13, 12-14 and 13-14 years of age groups in terms of both age and sexes (p<.001) (Table 2).

Table 2. Multiple Comparison Test for right hand gripping strength concerning age groups

Variables	Groups		(I-J)	St.	P
	(I)AGE	(J)AGE			
Right hand gripping strength	12 Age	13 Age	-3.636	.578	.000*
		14 Age	-6.094	.590	.000*
	13 Age	14 Age	-2.458	.535	.000*

Table 3. Sit and Reach Test (Flexibility) Results (cm) concerning age groups of female and male students

	FEMALE (n) X±Sd	MALE (n) X±Sd	TOTAL (n) X±Sd
12 Age	(89) 7,98±5.38	(83) 6,32±4,18	(172) 7,18±4,89
13 Age	(120) 8,41±5,18	(131) 6,04±4,97	(251) 7,18±5,20
14 Age	(114) 9,35±4,85	(113) 6,36±5,65	(227) 7,86±5,46
TOTAL	(323) 8.52±5.13	(327) 6.24±4.93	(650) 7.40±5.18

Table 4. Multiple Comparison Test for Sit and Reach Test concerning Age Groups

Variable	Groups		(I-J)	St.	P
	(I)AGE	(J)AGE			
Sit and Reach Test	12 Age	13 Age	,0006	,502	1,000
		14 Age	-,6847	,513	,550
	13 Age	14 Age	-,6853	,465	,424

In the study, female students had better scores in sit and reach test than male students in all age groups. As a result of the Variance Analysis, no statistically significant difference was detected between ages in terms of sit and reach test results, while the difference between sexes was found significant (F=33.582, P=.00).

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Table 5. 30-second pull-up Results (number) of Female and Male students concerning age groups

	FEMALE (n) X±Sd	**MALE (n) X±Sd**	**TOTAL (n) X±Sd**
12 Age	(89) 17,65±3,88	(83) 19,95±3,83	(172) 18,75±4,01
13 Age	(120) 16,11±3,97	(131) 19,56±3,90	(251) 17,91±4,29
14 Age	(114) 16,73±3,55	(113) 20,77±3,68	(227) 18,76±4,14
TOTAL	(323) 8.52±5.13	(327) 6.24±4.93	(650) 7.40±5.18

As can be seen in Table 5, pull-up tests were 17.65 in females and 19.95 in males aged 12 years, 16.11 in females and 19.56 in males aged 13 years and 16.73 in females and 20.77 in males aged 14 years.

Table 6. Multiple Comparison Test for 30-Second Pull-Up Test concerning Age Groups

	Groups		**(I-J)**	**St.**	**P**
	(I)AGE	**(J)AGE**			
30-Second Pull-Up Test	12 Age	13 Age	,8381	,502	,081
		14 Age	-,0101	,513	1,000
	13 Age	14 Age	-,8481*	,349	,047

A statistically significant difference was detected between age groups (13 and 14 years) in 30-second Pull-Up Test (F=4.622, P=.01). The multiple comparison test results demonstrated that the difference between 13 and 14 years of age groups was statistically significant in terms of both age and sexes (p<.001) (Table 6).

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Table 7. Standing Long Jump Test Results of Female and Male Students Concerning Age Groups

	FEMALE (n) X±Sd	**MALE (n) X±Sd**	**TOTAL (n) X±Sd**
12 Age	(89) 134,37±17,50	(83) 146,51±21,50	(172) 140,19±20,39
13 Age	(120) 130,44±19,57	(131) 147,31±21,91	(251) 139,21±22,43
14 Age	(114) 137,15±21,58	(113) 160,05±23,60	(227) 148,60±25,31
TOTAL	(323) 133.98±19.55	(327) 151.29±22.33	(650) 142.66±22.71

In Table 7, standing long jump test results are 134.37 cm in female students aged 12 years, 146.51 cm in male students; 130.44 cm in female students aged 13 years of age, 147.31cm in male students; and 137.15cm in female students and 160.05 cm in male students.

Table 8. Multiple Comparison Test for Standing Long Jump Test concerning Age Groups

Değişken	**Gruplar**		**Ort.Fark (I-J)**	**St. Hata**	**P Değeri**
	(I)YAŞ	**(J)YAŞ**			
Durarak uzun atlama	12 Yaş	13 Yaş	,9787	2,09	1,000
		14 Yaş	-8,4132*	2,14	,000
	13 Yaş	14 Yaş	-9,3919*	1,93	,000

There was a statistically significant difference between age groups (12, 13, and 14 years of age) in terms of standing long jump test (F= 13.898, P=.000). As a result of the multiple comparison test, the differences between both 12-14 and 13-14 years of age groups were statistically significant both for age and sexes (p<.000) (Table 8).

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Table 9. 30-Meter Sprint Test Results (sec) of Female and Male Students Concerning Age Groups

	FEMALE (n) X±Sd	MALE (n) X±Sd	TOTAL (n) X±Sd
12 Age	(89) 5,94±,502	(83) 5,54±,49	(172) 5,75±,53
13 Age	(120) 5,88±,62	(131) 5,39±,47	(251) 5,63±,60
14 Age	(114) 5,68±,47	(113) 5,17±,56	(227) 5,43±,57
TOTAL	(323) 5.83±.53	(327) 5.36±.50	(650) 5.60±.56

Table10. Multiple Comparison Test for 30-Meter Sprint Test concerning Age Groups

Variables	Groups		(I-J)	St.	P
	(I)AGE	(JAGE			
30-Meter Sprint Test	12Age	13 Age	,1257	,052	,050
		14 Age	,3203*	,053	.000*
	13 Age	14 Age	,1946*	,048	.000*

Male students completed the 30 meter sprint in shorter times than female students, and the differences between 12, 13, and 14 years of age groups were found statistically significant (F=18.534,P=.000). As a result of the multiple comparison test, the differences between 12—14 and 13-14 years of age groups were statistically significant (p<.000). The difference between 12 and 13 years of age groups was not statistically significant (Table 10).

Table 11. 1609-Meter Running Test Results of Female and Male Students concerning Age Groups

	FEMALE (n) X±Sd	MALE (n) X±Sd	TOTAL (n) X±Sd
12 Age	(89) 12,96±2,35	(83) 10,48±2,09	(172) 11,80±2,55
13 Age	(120) 12,73±2,30	(131) 10,41±2,04	(251) 11,51±2,46
14 Age	(114) 11,95±1,86	(113) 9,54±1,80	(227) 10,77±2,19
TOTAL	(323) 12.54±2.17	(327) 10.14±1.97	(650) 11.36±2.4

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Table12. Multiple Comparison Test for 1609-Meter Running Test Results concerning Age Groups

Variables	Groups		(I-J)	St.	P
	(I)AGE	(J)AGE			
1609-Meter Running Test	12 Age	13 Age	,2928	,211	,501
		14 Age	1,0267*	,220	,000
	13 Age	14 Age	,7339*	,201	,001

There were significant differences between 12, 13 and 14 years og age groups in terms of 1609-meter running times (F=12.114, P=.000). Similarly, the difference between sexes was also significant (F=193.811, P=.000). As a result of the multiple comparison tests, significant differences were determined between both 12-14 and 13-14 years of age groups (p<.001). However, the difference between 12-13 years of age groups was not statistically significant, while male students had shorter running times than female students (Table 11, 12).

Discussion

In this study, male students were determined to demonstrate better performance than female students in all motoric tests except for the flexibility measured by sit and reach test. The mean scores of female students were higher in sit and reach test than those of male students.

Male students demonstrated better performances than female students in right hand gripping strength, left hand gripping strength, standing long jump test, 30-sec pull-up test, 30-meter sprint test and 1 mile (1609 m) running test.

According to study results, the mean scores of female students in flexibility test were higher than those of male students.

Similar studies reported that the mean scores of females in flexibility tests were higher than those of males. In addition, there are studies reporting that females demonstrated lower performances in other physical performance tests (Çolak, 2006, Fortier et al., 2001, Pangrazi and Corbin, 1990, Ziyagil et al., 1999). In the present study, the results of female and male students were compatible with the findings in literature.

Pangarazi et al. (1990) carried out a study to investigate the effect of age and sex on test performances with sit and reach test, and reported that females had better flexibility than males and there was no difference in changes based on age.

Talema and Yang (2000) stated that males had higher activity levels than males. They also expressed that decreases in physical activity levels were related to adolescence period.

Many previous studies reported that body composition and structure were related to physical performance. Studies demonstrated that higher body fat had negative effects on exercise performance and physical efficiency (Docherty and Gaul 1991).

In this study, it could be suggested that the sexual differences in physical performance tests except for flexibility were caused by physical activity level, muscle mass, and body fat rate, while the performance differences in sit and reach test were caused by sexual differences in body composition.

Motor performances of students were quite low compared to standard health values of Fitnessgram and the results of previous studies. The possible reasons could be the sedentary lifestyle and the decrease in the hours of physical education and sport class in the curriculum of Ministry of Education to only 1 hour a week (http://candir.meb.gov.tr/belgem/ilkders.doc). Students began to live an exam-based life in and out of school with the application of Placement Test in 6^{th}, 7^{th} and 8^{th} classes correspondent to 12-14 years of age groups. Students face with a sedentary lifestyle as they spend only one hour a week in physical education and sport class during the school hours, and they have to spend a great deal of time in private teaching institutions out of school hours, which increases the risk of obesity and unhealthy society. This result is quite worrisome for the future of nation. It is considered to be of great importance to organize programs and interventions to increase physical activity level, sports capability and mobility of children in school and living spaces, which will make great contributions to form healthy individuals and society.

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