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An Examination of the Physical Parameters and Respiratory Function of Child Gymnasts

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Abstract

This study examines the physical parameters of child gymnasts. A total of 39 children, 24 females and 15 males, with a mean age of 5.75±1.08, participated in the study voluntarily. Their heights and weights were measured. A 10-meter sprint test to measure acceleration and speed, a flexibility test, and a hand reaction test was done. Respiratory function forced vital capacity (FVC), the first second forced expiration volume (FEV1), peak expiratory flow (PEF), skin calibration off body fat composition (BFC) tests were also conducted. SPSS 22.0 software was used for the statistical analysis. Descriptive statistics and frequency analysis were used to determine the distribution of the variables. The t-test was conducted in independent groups to determine the differences in physical parameters and respiratory functions by gender. The difference between the groups was significant for BFC, but not significant for other physical parameters, and there was no significant difference in respiratory function by gender.

Keywords: Respiratory Functions, Child Gymnasts, Physical Parameters

Introduction

Gymnastics is a sport that goes back to ancient Greek, Egypt, Indian civilizations. The first types of gymnastics were in the early ages of mankind when they started to live as a community in ancient rituals where they offered sacrifices to get along with the gods (Morpa Sports Ency. 1997). Gymnastics attracts the attention of many people in international competitions. Challenging gymnastic moves, dynamic jumps, and rhythmic swings are shows where art and sports merge together (Cihaner, 1998). Gymnasts must have proportional bodies, thin, but with developed muscles and a highly developed neuromuscular coordination in order to execute the extreme movements typical of gymnastics (Bağcı, 2003). This study examines the effects of gymnastics on young boys' and girls' physical parameters. It has become an evident fact that there are differences and ordinary developments in small children's reaction times, flexibility, body fat composition, and respiratory function. One factor is the lung functionality test, which is used for measuring the expanding volume and capacity of lungs and determining the expanding capacity of the respiratory tract, muscles and lungs (Kayatekin et. al., 1993; Yıldırım et al., 1996). Another test might be described as the creation of an impulse and a reaction to that impulse (Guyton, 1972; Taşkıran, 2007; Sevim, 2010) or the time difference between the start of an impulse and the start of a reaction (Tamer, 2000). It has also been reported that there is a genetic component to the reaction time between stimulations and first muscular reaction (Bompa, 1998). The flexibility factor, also called the range of motion, is the ability of a single joint or a joint group to move at the widest possible angle (Tamer, 2000). It is known that your flexibility depends on structural limitations such as bones, muscles, ligaments, joint capsules, tendons and skin (Baltacı, 2003). The body fat percentage parameter is affected by the tightness or looseness of the skin and subcutaneous fat tissue. When measuring skinfold thickness, it should be considered that there may be a difference between the values obtained from loose tissues and the values obtained from tight tissues (Lukaski, 1987) since two layers, skin and subcutaneous fat tissue, are measured.

This study examines some physical parameters and the respiratory function of child gymnasts by gender.

Materials and Methods

A total of 39 children, 24 girls, and 15 boys, with a mean age of 5.75±1.08, from the gymnastics branch of the Erzincan Youth Services and Sports Provincial Directorate, participated in the study voluntarily. In order to ensure voluntary participation, family approval was obtained because the age range was 4-8 years.

Official ID age records were taken as the age of the participants. Their heights were measured with a tape measure, and their weights were measured with a digital scale. In order to determine acceleration and speed, a 10-meter running test was conducted where the initial and endpoints were clearly marked and with the help of chronometer and audible sign (speed=distance traveled/time, acceleration=speed/time). The flexibility test was a sit & reach test bench. BFP was determined using a skinfold caliper. In order to measure respiratory function, a portable spirometer was used (MIR-Medical International Research Minispir-Italy). The participants performed the test with maximum exhalation. The test was repeated 3 times and the best result was selected and recorded by assessing forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and peak flow rate (PEF) (Marangoz et al., 2016). The Nelson reaction scale was used in determining dominant hand reaction, and

reaction times were determined by calculating the value on the ruler using these formulas (Tamer, 2000):

Reaction Time=√2 x Distance to where the ruler fell/Speed-Related to Gravity

Reaction Time=√2 x Distance(cm)/980 ms

SPSS 22.0 software was used for statistical analysis of the data. Descriptive statistics and frequency analysis were applied to determine the distributions of the variables. The t-test was used to determine the difference in physical parameters and respiratory function by gender. The results are presented as means, percentages and standard deviations. The threshold for statistical significance was $p<0.05$.

Results

Table 1. The Distribution of Participants by Gender

Gender	Frequency (f)	Percentage (%)
Girl	24	61.5
Boy	15	38.5
Total	39	100.0

Table 2 shows that the mean age of the participants was 5.75±1.08 years, their mean height mean was 114.08±7.59 cm, and their mean weight was 21.10±3.85 kg.

Table 2. Physical Parameter Distributions

Variables	n	Minimum	Maximum	X	*SD*
Age (years)	38	4	8	5.75	1.08
Height (cm)	39	101	129	114.08	7.59
Weight (kg)	39	13.20	28.50	21.10	3.85

Table 3. The Mean Values of the Physical Parameters

Variables	Sex	n	X± *SD*
10 Meters (s)	Girl	24	2.56±0.46
	Boy	15	2.28±0.48

Speed (s)	Girl	24	4.03±0.73
Acceleration (s)	Girl	24	1.67±0.60
Flexibility (cm)	Girl	24	29.00±5.12
	Boy	15	28.26±4.49
Reaction Time (s)	Girl	24	0.04±0.01
	Boy	15	0.04±0.01
BFP (%)	Girl	24	21.94±3.83
	Boy	15	18.45±3.92

Table 3 shows that the boys had better 10-meter speed and acceleration values. Reaction times were in the same range for both genders, and the girls had better flexibility and BFP.

Table 4. The Mean Values for Respiratory Function

Variables	**Sex**	**n**	**X± *SD***
FVC (l)	Girl	24	1.43±0.83
	Boy	15	1.28±0.77
FEV1 (l)	Girl	24	0.81±0.28
	Boy	15	0.90±0.33
PEF (l)	Girl	24	1.64±0.80
	Boy	15	1.76±0.82

Table 4 shows that the girls had higher FVC values, and the boys had higher FEV1 and PEF values.

Table 5. The Differences in Respiratory Function by Gender

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper

FVC	E.v.a.	.084	.773	.576	37	.568	.15367	.26689	-.38711	.69444
	E.v.n.a			.585	31.450	.563	.15367	.26255	-.38150	.68883
FEV1	E.v.a.	.425	.518	-.806	37	.425	-.08083	.10027	-.28399	.12233
	E.v.n.a			-.779	26.644	.443	-.08083	.10372	-.29378	.13211
PEF	E.v.a.	.296	.590	-.471	37	.640	-.12592	.26722	-.66736	.41553
	E.v.n.a			-.467	29.060	.644	-.12592	.26946	-.67697	.42513

Table 5 shows that there was no significant difference in the girls' and boys' respiratory function.

Table 6. Comparison of Some Physical Parameters by Gender

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
10 meters	E.v.a.	1.530	.224	1.768	37	.085	.27375	.15482	-.03995	.58745
	E.v.n.a			1.745	28.572	.092	.27375	.15691	-.04737	.59487
Flexibility	E.v.a.	.428	.517	.455	37	.652	.7333	1.6110	-2.5309	3.9976
	E.v.n.a			.469	32.795	.642	.7333	1.5622	-2.4458	3.9125
BFP	E.v.a.	.249	.621	2.737	37	.009	3.48543	1.27358	.90492	6.06594
	E.v.n.a			2.721	29.321	.011	3.48543	1.28076	.86722	6.10364
Reaction Time	E.v.a.	.019	.891	-.285	37	.777	-.00108	.00380	-.00879	.00662
	E.v.n.a			-.265	23.423	.793	-.00108	.00408	-.00952	.00735

Speed	E.v.a.	2.105	.155	-2.017	37	.051	-.47453	.23531	-.95132	.00226
	E.v.n.a			-2.055	31.671	.048	-.47453	.23095	-.94515	-.00390
Acceleration	E.v.a.	2.147	.151	-2.084	37	.044	-.39641	.19017	-.78174	-.01108
	E.v.n.a			-2.144	32.555	.040	-.39641	.18490	-.77278	-.02004

The table 6 shows that the differences by gender were statistically significant in the BFP, speed and acceleration parameters, but the differences in the remaining parameters were not significant.

Discussion and Condusion

The physical factors examined in the present study have been the subject of many studies in the literature. These factors include information that can be given as an example and would support the results of this study. Bağcı (2003) compared the physical characteristics of a 9-11 age group of rhythmic gymnastics and artistic gymnastics athletes and determined that the mean height of the artistic gymnasts was 133.00 cm and that the mean height of the rhythmic gymnasts was 136.72 cm. Bulca and Ersöz (2004) found that the body fat ratio was 14.2±0.9% in rhythmic gymnasts and 20.5±3.2% in sedentary girls. Özer (2001) showed that, unlike other physical fitness parameters, elasticity decreases with age. The elasticity of children is constant from 5 to 8 years old, reaches its maximum at 12-13 years, and then decreases with age. He also noted that girls are more flexible than males at all ages and that the biggest gender differences are seen during puberty and maturity. Kılıç (2007) found that the mean sit & reach elasticity test value of 7-year old students was 12.86±6.95 cm, the mean sit & reach elasticity test value of 8-year old students was 13.43±7.36 cm. The mean sit & reach elasticity test value of 10-year-old students was 12.35±7.66 cm, and the mean sit & reach elasticity test value of 11-year-old students was 10.59±7.50 cm.

The mean age of this study's participants was 5.75±1.08, the mean height was 114.08±7.59, and the weight mean was 21.10±3.85. The mean of the 10-meter test was 2.56±0.46 for the girls and 2.28±0.48 for the boys. The mean of speed was 4.03±0.73 for the girls and 4.50±0.67 for the boys. The mean acceleration was 1.67±0.60 for the girls and 2.07±0.53 for the boys. The mean of flexibility was 29.00±5.12 for the girls and 28.26±4.49 for the boys. The mean reaction time was 0.04±0.01 for the girls and 0.04±0.01 for the boys. The mean BFP was 21.94±3.83 for the females and 18.45±3.92 for the males. The mean FVC was 1.43±0.83 for the girls and 1.28±0.77 for the boys. FEV1 was 0.81±0.28 for the girls and 0.90±0.33 for the boys. The PEF value was 1.64±0.80 for the females and 1.76±0.82 for the males. This study found that males had better speed and acceleration values at 10 meters, that their reaction times were the same, and that the females had better flexibility rate and higher BFP and FVC values. The males had higher FEV1 and PEF values. There was no significant difference in respiratory function between the males and females. This study found that the differences between the groups were significant in the parameters of BFP, speed, and acceleration, but no significant differences were the other parameters. These results cannot be linked to hormone levels since the mean age was 4-8. When considering the effects of gender

differences on physical abilities, genetic development, personal development and the fact that all parameters peak at different ages due to gender differences should also be taken into consideration. The differences determined by this study may be related to this.

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Conflict of Interest

The authors have not declared any conflicts of interest.

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