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Differences in anthropometric and morphological characteristics, as well as motor abilities, between boys and girls aged thirteen to fifteen.

Adis Bekrić[1], Ilma Tutnjić[1], Adis Tabaković[2], Ekrem Čolakhodžić[3], Almir Atiković[1]

[1] University of Tuzla, Faculty of Physical Education and Sport, Bosnia and Herzegovina
[2] University of Sarajevo, Faculty of Sport and Physical Education, Bosnia and Herzegovina
[3] Faculty of Education, University Džemal Bijedić of Mostar, 88000 Mostar, Bosnia and Herzegovina

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Abstract
This paper aims to determine whether there is a difference in anthropometric, morphological characteristics, and motor abilities, between boys and girls at the age of 13-15 years. The study included 95 subjects of which 49 were boys (51.6%) and 46 girls (48.4%), with mean age girls 14.14 and boys 14.40 years. The sample comprised students who belong to the urban area of the City of Tešanjka. The sample of variables in this study consisted of 15 tests of motor abilities and 10 morphological characteristics (body height, body mass, body mass index, etc.). This paper aims to determine whether there are differences in anthropometric characteristics and motor abilities between boys and girls aged 13-15 years. The results obtained in this study were compared with those of previous research, and the conclusions reached through a summary analysis were explained. Boys were taller and heavier at the age of 14. The results show that boys achieved statistically better results in most tests compared to girls of the same age.

Keywords: anthropometric characteristics, motor abilities, gender differences, age of fourteen

INTRODUCTION

Motor abilities, that is, their level, are very important for the optimal growth and development of children, and therefore for their health. They naturally develop from birth and their development experiences certain changes that occur over the years, especially in youth, and this development is not always the same in boys and girls. For each motor ability, there is a certain period in which the greatest changes are achieved. Individual differences in the dynamics of growth are a significant source of variability in the form, function, and capabilities of the human body. The turbulent and complex phenomenon of growth and development is a regular process in which we can define a series of laws within which the individuality of the rate of change arouses special interest, especially about the demands placed on the organism by physical activity (Mišogoj-Duraković, 2008; Atiković et al., 2023). Growth and development are defined by a series of endogenous (genetic, hormonal) and exogenous (nutrition, physical activity, socioeconomic, psychological, climatic, etc.) factors. Sexual dimorphism in most growth and development parameters becomes more significant during sexual maturation, and until then most characteristics develop in parallel in girls and boys (Prskalo, Samac & Kvesić, 2009: Prskalo, Kraljević & Kovačić, 2011; Užičanin et al., 2023). Physical activity is cited as one of the exogenous factors influencing growth and maturation (Mišogoj-Duraković, 2008, Prskalo et al., 2011).

This paper aims to determine whether there are differences in anthropometric characteristics and motor abilities between boys and girls aged 13-15. The results obtained in this study were compared with those of previous research, and the conclusions reached through a summary analysis were explained.

MATERIAL AND METHODS

Design and sample

Enrolment in the study was voluntary and involved 95 girls and boys at the Elementary school „Kulin Ban“ Tešanjka. Boys and girls at the average age of 14 years. The study included 95 subjects of which 49 were boys and 46 girls mean age girls 14.14 and boys 14.40 years. The sample comprised students who belong to the urban area of the City of Tešanjka.

The sample of variable

Physical fitness tests were measured using the EUROFIT test battery (Adam et al., 1988). This battery consists of several tests which measure the

basic motor capacity of the subjects. All tests were performed under standardized conditions. Body height was measured using Martin's anthropometer with a precision of 0.1 cm, and BMI was measured using a Tanita TBF-300A Pro Body Composition analyzer scale with a precision of 0.1 kg (Tanita Corp., Tokyo, Japan). For measuring bunny hop distance (cm) and speed passage at 9 meters we used BTS - Wireless Sprint System. Times are accurate to 1/100th of a second. To measure the characteristics of jumps we used the laser system Optojump length of 2 meters. Optojump has high values of reliability, time series are measured in 1/1000th second. Optojump we measure the following variables: time of flight phase (s), and height of the jump (cm).

The sample of variables consisted of 15 motor skills tests and 10 measures of morphological characteristics. In the field of morphological anthropometry, each student's height and body mass were measured. All measurements were carried out using standard procedures described in the instructions of the International Biological Program (IBP - 12). Body mass index was calculated from height and body mass. Motor skills were measured with a set of 15 motor tests. The following tests were used for testing and measurement purposes: years of age, body height (cm), body weight (cm), body mass index (BMI) (kg/m^2), fat tissue (%), body fat (kg), fat-free mass, muscle mass, water in the body (kg), water in the body (%), pushups (freq.), trunk lift front (60 sec.), trunk lift back (60 sec.), bunny jumps forward (9 m), agility t-test (sec.), bear walk backward (9 m), agility Ilinois test (sec.), long jump on two legs (cm), throwing a medicine ball (1 kg) (cm), sprint from a high start (20 m), shuttle run 20m (m), vo2max, deep (drop) jump DJ (20 cm), squat jump SJ (cm), countermovement jump CMJ (cm), countermovement jump with arms CMJA (cm). A detailed description of the tests is available in the papers: Metikoša et al., 1989, Findak et al., 1996, Metikoša et al., 2003; Begatović, Čuk & Atiković, 2010; Badrić, 2011, Begatović et al., 2012; Emić et al., 2017; Atiković et al., 2023; Užičanin et al., 2023.

Data analysis

Data obtained in this study were analyzed using a software system for multivariate and univariate data analysis SPSS 27.0 (SPSS Inc, Chicago, USA) data processing was performed at the Faculty of Physical Education and Sport of Tuzla, University of Tuzla. We used standard statistical procedures to determine the following basic parameters and variables. The mean (M) and standard deviation (SD) were calculated, and ANOVA was used to determine differences between groups of subjects was calculated. The statistical significance level was set at $p < 0.05$.

RESULTS

We notice the following when we look at the results of descriptive statistics for boys and girls regarding anthropometric and morphological indicators. Girls are younger than boys and statistically, the two groups differ. There was a statistically significant difference between groups' years of age as determined by one-way ANOVA ($F(1,93) = 4.54$, $p < .03$). There is a difference in body height ($F(1,93) = 35.46$, $p < .00$), body weight ($F(1,93) = 5.59$, $p < .02$). body mass index there is no difference, fat tissue ($F(1,93) = 48.50$, $p < .00$), body fat ($F(1,93) = 13.82$, $p < .00$), fat-free mass ($F(1,93) = 68.82$, $p < .00$), muscle mass ($F(1,93) = 68.62$, $p < .00$), water in the body ($F(1,93) = 69.00$, $p < .00$) and water in the body ($F(1,93) = 48.42$, $p < .00$).

We notice the following when we look at the results of descriptive statistics for boys and girls regarding motor capabilities. Girls are statistically weaker than boyss in all variables. There was a statistically significant difference between groups' trunk lift front as determined by one-way ANOVA ($F(1,93) = 16.91$, $p < .00$). There is a difference in bunny jumps forward ($F(1,93) = 25.99$, $p < .00$), Agility T-test ($F(1,93) = 49.49$, $p < .00$), Agility Ilinois test ($F(1,93) = 48.86$, $p < .00$), long jump on two legs ($F(1,93) = 60.25$, $p < .00$), throwing a medicine ball ($F(1,93) = 64.96$, $p < .00$), sprint from a high start ($F(1,93) = 60.48$, $p < .00$), shuttle run 20m ($F(1,93) = 14.83$, $p < .00$), VO2max ($F(1,93) = 12.02$, $p < .00$), deep jump ($F(1,93) = 27.19$, $p < .00$), SJ ($F(1,93) = 36.84$, $p < .00$), SJ ($F(1,93) = 36.84$, $p < .00$) CMJ ($F(1,93) = 45.04$, $p < .00$) and CMJA ($F(1,93) = 56.13$, $p < .00$). There were no statistically significant differences in the two variables as determined by one-way ANOVA pushups ($F(1,93) = .81$, $p < .36$) and trunk lift back ($F(1,93) = 2.86$, $p < .09$).

Table 1. Descriptive statistics and ANOVA anthropometric and morphological characteristics

Variables		N	M	SD	Min	Max	df	F	p
Years of age	girls	46	14.14	.50	13.09	15.50	1	4.54	.03
	boys	49	14.40	.69	12.37	15.46	93		
							94		
Body height (cm)	girls	46	164.86	4.96	154.00	176.00	1	35.46	.00
	boys	49	173.79	8.95	151.00	190.00	93		
							94		
Body weight (cm)	girls	46	59.35	12.75	39.80	91.90	1	5.59	.02
	boys	49	65.72	13.45	39.30	108.60	93		
							94		
Body mass index (BMI) (kg/m2)	girls	46	21.73	3.93	15.00	30.50	1	.00	.99
	boys	49	21.74	4.24	16.20	37.10	93		
							94		
Fat tissue (%)	girls	46	25.51	7.90	9.60	38.90	1	48.50	.00
	boys	49	14.69	7.24	3.00	36.60	93		
							94		
Body fat (kg)	girls	46	16.06	7.95	4.00	35.20	1	13.82	.00
	boys	49	10.34	7.03	1.50	39.70	93		
							94		
Fat-free mass	girls	46	43.29	5.04	34.40	56.70	1	68.82	.00
	boys	49	55.28	8.49	35.70	68.90	93		
							94		
Muscle mass	girls	46	41.08	4.79	32.60	53.80	1	68.62	.00
	boys	49	52.50	8.11	33.80	65.50	93		
							94		
Water in the body (kg)	girls	46	31.66	3.71	25.20	41.50	1	69.00	.00
	boys	49	40.47	6.22	26.10	50.40	93		
							94		
Water in the body (%)	girls	46	54.52	5.77	44.70	66.10	1	48.42	.00
	boys	49	62.39	5.25	46.40	71.00	93		
							94		

Notes: N – no. of performances; Min, Max – lowest and highest value; M – mean; SD – standard deviation; significant at the ($p < 0.05$) level.

Table 2. Descriptive statistics and ANOVA motor capabilities

Variables		N	M	SD	Min	Max	df	F	p
Pushups (freq.)	girls	46	4.61	2.71	0	11	1	.81	.36
	boys	49	5.47	5.88	0	30	93		
							94		
Trunk lift front (60 sec.)	girls	46	6.59	5.13	0	23	1	16.91	.00
	boys	49	11.41	6.20	1	25	93		
							94		
Trunk lift back (60 sec.)	girls	46	24.76	10.59	0	45	1	2.86	.09
	boys	49	28.55	11.21	1	51	93		
							94		
Bunny jumps forward (9 m)	girls	46	8.93	4.02	4.97	23.31	1	25.99	.00
	boys	49	5.82	1.36	3.73	9.48	93		
							94		
Agility T-test (sec.)	girls	46	17.15	2.27	13.91	27.06	1	49.49	.00
	boys	49	14.41	1.46	12.42	20.41	93		

							94		
Bear walk backwards (9 m)	girls	46	13.00	4.37	7.75	25.88	1	31.15	.00
	boys	49	8.76	2.93	5.58	18.74	93		
							94		
Agility Ilinois test (sec.)	girls	46	22.96	2.31	19.16	28.90	1	46.86	.00
	boys	49	19.62	2.43	7.04	24.04	93		
							94		
Long jump on two legs (cm)	girls	46	127.41	21.12	74.00	180.00	1	60.25	.00
	boys	49	171.22	32.34	47.00	246.00	93		
							94		
Throwing a medicine ball (1 kg) (cm)	girls	46	538.91	96.79	330.00	740.00	1	64.96	.00
	boys	49	760.34	160.96	410.00	1150.00	93		
							94		
Sprint from a high start (20 m)	girls	46	4.79	.50	4.05	5.94	1	60.48	.00
	boys	49	4.10	.36	3.57	5.04	93		
							94		
Shuttle run 20m (m)	girls	46	253.47	84.43	80.00	480.00	1	14.83	.00
	boys	49	390.61	227.12	120.00	1000.00	93		
							94		
VO2max	girls	46	21.57	1.84	17.60	26.50	1	12.02	.00
	boys	49	24.16	4.74	14.70	36.10	93		
							94		
Deep jump DJ (20 cm)	girls	46	12.53	4.35	4.20	21.60	1	27.19	.00
	boys	49	18.34	6.27	5.90	33.10	93		
							94		
Squat jump SJ (cm)	girls	46	17.68	4.09	8.20	26.30	1	36.84	.00
	boys	49	24.13	6.01	5.70	37.40	93		
							94		
Countermovement jump CMJ (cm)	girls	46	17.44	4.02	8.90	25.40	1	45.04	.00
	boys	49	24.31	5.74	8.70	33.30	93		
							94		
Countermovement jump with arms CMJA (cm)	girls	46	20.49	3.78	11.40	26.60	1	56.13	.00
	boys	49	29.64	7.42	8.90	48.70	93		
							94		

Notes: N – no. of performances; Min, Max – lowest and highest value; M – mean; SD – standard deviation; significant at the ($p < 0.05$) level.

DISCUSSION AND CONCLUSION

In Bosnia and Herzegovina, according to the study on the State of Health of the adult population in the Federation of Bosnia and Herzegovina (2012), 37.5% of the population is in the overweight category (BMI = 25-29), and 21.2% is in the obesity category (BMI ≥ 30), which is very worrying data (Ramić-Čatak, 2014). In the Sarajevo Canton of the Federation of Bosnia and Herzegovina, in the observed population of students from 1st to 9th grade of primary schools, 39.6% are overweight or obese. In terms of gender, 43.9% of boys and 35.2% of girls are overweight or obese. 9.7% are undernourished, 9.2% of boys and 10.1% of girls (Abazović et al., 2016). A study conducted in 2017 in the City of Mostar, on the population of primary school students of both sexes who participated in a regular systematic examination during 2016, showed that 36.4% of students are overweight or obese. To gender, 34.4% of boys and 38.5% of girls are overweight or obese. 7.4% are malnourished, of which 7.2% are boys and 7.6% are girls. Almost every second child (43.9%) has an eating disorder, which is worrying and alarming (Čolakhodžić et al., 2017).

Based on the reviewed results, it is evident that boys and girls also differ in anthropometric, morphological characteristics, and motor abilities in an observed years. Looking at the results of students aged 13-15 in terms of morphological characteristics, it can be concluded that boys are almost 8.93 centimeters taller than girls and that they are on average around 6.37 kilograms heavier. This increase in height and weight in favor of boys

is expected. In their research, several authors (Martinez et al., 2010; Strel et al., 2003) obtained different results for students aged 14 and over, with boys having higher body height and body mass values than girls. Boys are taller and heavier than girls at both the ages of thirteen and fourteen. Most previous research has recorded slightly different relationships, namely, that girls are usually taller than their peers at the age of thirteen.

Girls have better values in motor tests, so analyses have shown that differences exist at the age of 14. The results for boys show that they dominate in all variables. These results are in line with several studies conducted so far (Orjan et al., 2005; Ortega et al., 2011). Kondrić & Šajber (1997) state that during adolescence, gender differences in motor skills occur, with the largest differences occurring at age 13. According to our results, boys between the ages of thirteen and fifteen improve their scores in tests assessing almost all observed motor skills. Stagnation was observed only in the pushups (freq.) and trunk lift back (60 sec.) tests.

Based on the conducted research, it is concluded that girls at the age of fourteen have weaker results in the area of anthropometric characteristics, coordination, explosive strength, repetitive strength, speed, and frequency of simple movements. Boys dominate at this age, which differs from some previous research (Prskalo et al., 2011). As in the area of morphological characteristics that are linked to biological differences primarily determined by gender, differences between the subsamples of boys and girls are also evident in motor abilities. Based on the ANOVA analysis, it can be confirmed that there are significant differences in the level of motor abilities between the subsamples defined by gender.

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Correspondence to:
Almir Atiković,
University of Tuzla
Faculty of Physical Education and Sport
2.oktobra br.1, 75000 Tuzla, BiH
Phone:+387(0)35 278 535
E-mail: atikovic.almir@gmail.com