



## GENDER DIFFERENCES IN DEVELOPMENT OF EXPLOSIVE POWER AND RAPIDITY IN SCHOOLCHILDREN AGED 14-15 YEARS OLD

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### Abstract

The primary task of physical education is the harmonious development of all anthropological parameters and characteristics of children. Knowing the motor skills of pupils, male and female, is directly related to the effects of physical education classes and the development of individual motor skills. The aim of this research was to determine the differences in the quantitative motor skills between boys and girls. The sample includes a population of 42 primary school students from primary school Serbia in East Sarajevo, aged  $14 \pm 0.5$  years divided into two sub-categories. The variable long-jump variation (MDSM-cm) has been used to estimate the explosive power, while the variable 30 meters sprint (MT30V-sec) has been used to estimate the acceleration. By analyzing the T-test, statistically significant differences between boys and girls have been found.

**Key words:** Testosteron, sex, step length, morphological characteristics.

### INTRODUCTION

Physical education is a key component of quality education and an integral part of lifelong learning. Physical education gives students knowledge, skills and understanding necessary for performing various physical activities, preservation of physical condition, appreciation of physical activity as a segment of active lifestyle, as well as enjoyment of physical activity (Hardman, 2007; Đorđić and Tumin, 2008). Physical education must be well-planned, and the main goal should be multifaceted development of children (Broomfied, 2011), that is, physical education is strongly recommended because of its effectiveness in raising physical form and developing positive habits for regular exercise of physical activity among young people and children (Task Force on Community Preventive Services, 2002; Blagiy and Andreeva, 2011; Ayers and Sariscsany, 2013). The primary task of physical education is the harmonious development of all anthropological parameters and characteristics of children (Vehapi, Pireva and Pireva, 2013). An important segment of the anthropological space consists of motor skills based on which information about the motor functioning of a person is obtained and as such plays an important role in achieving

the sport result (Radinović and Pavlović, 2013). Knowing the motor skills of pupils and students is directly related to the effects of physical education classes and the development of individual motor skills (Batez et al., 2011). Appropriate level of motor skills enables successful learning of more complex motor tasks, skills and habits which are an inseparable factor in the integral development of a child (Kukulj et al., 1997; Milanović, 2007; Arefiev, V.G., 2014).

Motor skills are an important and complex system that manifests itself in the movement of man both in daily activities and in more complex situations that are characteristic of various physical activities of students (Mišigoj-Duraković, 2008; Gađžić and Marković, 2014), also, the level of development of motor skills of students significantly contributes to their proper growth and development (Gađžić and Vučković, 2012), and therefore their health (Prskalo et al., 2011). The consistency of the order of development of motor abilities is observed depending on age (Drid, Trivić and Obadov, 2009; Khudolii and Titarenko, 2010). The level of motor skills increases with the age of the students, and in girls they reach the plateau in 14, and in the boys a little later. During adolescence, there are differences between sexes in motor skills, and the biggest differences occur in the 13th year (Strel, 2006; Kondrič and Šiber, 1997). Biologically mature boys respond better to physical training than girls (Malina, 1994). The motor skills of elementary school students were often the subject of research in physical culture (Pavlova, 2013; Gađžić and Marković, 2014). Several authors dealt with differences between pupils and students of different ages in motor skills (Gelemanović, Svoboda and Tomas, 2006; Mladineo, 2006; Mikalački and Čokorilo, 2007; Georgiev, Aleksandrović and Petrov, 2009; Badrić, 2011; Kraljević, Gađžić and Vučković, 2013; Pelemiš, Pelemiš, Mitrović and Džinović, 2014; Kerić and Ujsaši, 2014; Gađžić and Marković, 2014; Ivashchenko, O. et al., 2015, 2016, 2018). Because of that, the aim of this research is focused on determining the differences in the quantitative motor skills between boys and girls, who regularly attend classes of physical education.

## **MATERIAL AND METHODS**

### **Population**

The research includes the population of elementary school students from elementary school Serbia, East Sarajevo (Bosnia and Herzegovina). The sample consists of a total of 42 students, aged  $14 \pm 0.5$  years, divided into two sub-classes: 21 boys and 21 girls who regularly attended physical education in the elementary school Serbia. The measurements have been realized in the physical education room of the elementary school in East Sarajevo. All students volunteered in measuring.

### **Measurements and data collection**

An explosive power, defined as the ability to activate the maximum number of muscle units in the unit of time (Dragaš, 1998), have been realized by the following variables: Standing long jump (MSDM-cm).

The speed of acceleration or acceleration phases is the first phase of effective running, when from standing phase a person comes to the max speed of running in the shortest period of time. The length of the initial

acceleration is 25-30 meters (Pavlović, 2014). Variable that has been used to estimate the acceleration: 30 meters standing start (MT30V-sec).

### Data analysis

The statistical package for personal computers SPSS Statistic 20.0 has been used for data processing. The basic central and dispersion parameters have been calculated, and the T-test module for small independent samples has been used to determine the differences.

### Results

Table 1 shows the descriptive statistics of motor skills for the sample of boys. The average running speed in 30 meters with boys was (5.09 sec) and they are on average faster than girls whose average speed is (5.74 sec). This is noticeable for minimum values, while the same results have been recorded at maximum values. Their range goes from (2.10 sec) in boys, to (1.70 sec) with girls.

**Table 1.** Descriptive student statistics

Variables	Gender	Mean	Min.	Max.	Range	Std. Dev.	Skewness	Kurtosis
Running30m	M	5.09	4.50	6.60	2.10	.44014	2.004	6.323
(MT30V-sec)	F	5.74	4.90	6.60	1.70	.36532	.075	1.036
Long Jump	M	190.05	150	231	81	22.833	.127	-.661
(MSDM-cm)	F	168.95	130	206	76	22.728	-.164	-.766

Similar conclusions are noticeable in the variable (Long Jump). The average length of the long jump in boys was (190.05 cm) and in girls (168.95 cm). The average length of the long jump is noticeable in minimum and maximum values ranging from (81 cm) in boys to (76 cm) in girls. Analysis of the symmetry of the results have shown statistically significant positive asymmetry in the variable (running 30 m) in boys, while the girls have formed a distribution of frequencies with statistically negative asymmetry in the variable (Long Jump). In terms of homogeneity, there is a leptokurtic curve in the variable (running 30 m) in the student, while in the Long Jump there is a platokurtic curve for boys and girls. Table 2 shows and identifies differences in motor abilities of boys with T-test for independent samples. By analyzing the value of the T-test, statistically significant differences between boys and girls were recorded. By inspecting the table 2. it is evident that there are statistically significant differences in the benefit of boys (Running 30 m  $p < 0.000$ ), (Long Jump  $p < 0.005$ ).

**Table 2.** Differences in students' motor skills (T-test)

Variables	Gender	Mean±Std.Dev.	t-Value	Sig. (2-tailed)	95% Confidence Interval of the Difference	
					Lower	Upper
Running30m	M	5.09±.44014	-5.192	.000*	-9.0037	-.39582
	F	5.74±.36532				
Long Jump	M	190.05±22.833	3.001	.005*	6.887	35.304
	F	168.95±22.728				

## DISCUSSION

Respecting the differences between boys and girls in physical education classes is the basis for proper planning and programming of the teaching process. It is especially important in the period from the year of 10 to 14, when the differences between the sexes are more obvious, and the correct load during the classes of physical education is the foundation of a harmonious development of the anthropological characteristics of students (Pelemiš et al., 2013). In the planning and programming of physical education classes special attention is paid to the timely development of motor skills that are in relation to anthropometric dimensions (Katić et al., 2005). As it has been previously pointed out, boys have achieved better results than girls in explosive power. It is expected that morphological differences are distinguished by systems of motor manifestations (Prskalo, Samac and Kvesić, 2009; Prskalo and Sporiš, 2016), because morphological characteristics are the basis for the later formation and development of motor skills (Breslauer, Delija and Jelenić, 2004; Di Cagno et al., 2009; Dedaj, 2011; Torlaković, 2014). The negative effect of body weight, and especially subcutaneous fat tissue, on success in the realization of various motor tasks was confirmed in a large number of scientific researches (Mota et al., 2002; Deforche et al., 2003; Kim et al., 2005; Strel, 2006; Stojanović et al., 2012), but not on explosiveness and speed that are highly genetically determined. Maximum speed (10-30 m) and jumping are explosive actions (Faude, Koch and Meyer, 2012), which should be developed from younger age (Lloyd and Oliver, 2012; Meylan et al., 2014). Explosive power is very important motor skill almost for all sports. It depends on the development of muscle mass, but also on the ripening of nerve-muscle units, or on the development of coordination (Popović et al., 2010). Explosive power is expressed by reactive ability and can be manifested as: explosive power of impact character and explosive power of a sharp impact character (Nićin and Lolić, 2010). In research (Gajić et al., 1981), which included boys and girls from 11-15 years old, they found that at any age from 11-15 years there is no explosive power of sharp impact character, while the explosive force of impact character is clearly visible in all of the mentioned ages. A significant increase in the strength of boys in post-puberty, but also in puberty is the result of an increase in muscle mass, which is due to increased testosterone secretion (Bijelić and Simović, 2005). The role of testosterone secretion in boys is very significant. In puberty, the secretion of testosterone in the testes is associated with a significant increase in the male muscle mass (Zatsiorsky and Kreamer, 2006); also, the level of testosterone is significantly increased after a training episode in boys from fourteen to seventeen years who train for at least two years (Kreamer and Fleck, 2005). Boys have achieved better results than girls in running at 30 meters. Children's sprint is different from adults, mainly due to differences in motor skills (Blažević, Novak and Petrić, 2014). During adolescence, various morphological characteristics have a significant impact on the characteristics of the racing step, primarily because of the length of the lugs that have a significant impact on the running technique (Likić, Bajramović and Vranešić-Hadžimehmedović, 2018). Babić (2005) found that respondents with better developed explosive power achieved a longer step in

sprint running. The length of the steps depends largely on the height of the body and the length of the legs (Čoh, Mihajlovič and Praprotnik, 2001), which means that the lower leg length and height do not allow the same length of steps in running as in sprinters, while the smaller muscle crossing and lower muscle mass interfere with the same development of muscular strength as in adults (Blažević, Novak and Petrić, 2014). The difference between sexes in step length, ages 14 to 15 in favor of boys was confirmed in the study (Kampmiller et al., 1996). The speed of movement depends primarily on the development of neuromuscular units (Popović et al., 2010). The greatest influence on the increase in speed has the rise in the power of the current muscularity, and it can be influenced indirectly by transferring primarily explosive and speed forces (Komi, 1992; Castro-Piñero, J. et al., 2010); also, the explosive force leads to the achievement of great acceleration and influences the development of the speed of movement (Milosevic, Kreft and Mučibabić, 2014). Acceleration is an extremely important phase that affects sprint results (Čoh et al., 2001). The initial acceleration is a complex cyclical movement defined predominantly by the progression of the frequency and length of the step, the duration of the contact and flight phase and the position of the center of gravity of the body at the moment of contact with the surface, the flight phase propulsion and the forces that are overcome in the first step (Hunter, Marshall and McNair, 2005; Pavlović et al., 2014). The muscular group m. quadriceps (m. rectus femoris, m. vastus lateralis, m. vastus medialis) plays a key role in the development of acceleration, which generates progression of the step (Čoh, 2003). According to the research (Mero, 1988; Coopenolle and Delecluse, 1989; Schot and Knutzen, 1992), the efficiency of the starting action depends primarily on the horizontal start speed and the starting time, resulting in the horizontal acceleration acceleration. Marković et al., (1996) state that lower values of motor skills in girls can not be attributed only to the specificities of their body, but also to the well-researched (Petrić, 2011) lower level of regular physical activity, and especially the lower engagement in organized recreational and sports activities. The current research is in line with the results of the research (Orjan, Kristjan and Bjorn, 2005; Mak et al., 2010; Starc, Strel and Kovač, 2010; Ortega et al., 2011; Farooq M. A. et al., 2017; Galan, Y. et al., 2017), which also defines the trend of changes in the motor abilities of the investigated population.

## **CONCLUSION**

The research was carried out with the aim of determining the quantitative differences between boys and girls, students of Elementary School Serbia in East Sarajevo in terms of motor parameters. A total of 42 students were analyzed, and on the basis of the obtained results, statistically significant differences were confirmed for the benefit of the boys. Based on all this, we can conclude that the differences in motor status between boys and girls are influenced by: prior physical activity, growth and development factors, anthropometric measures, morphological characteristics, the environment and a number of other factors. In addition to this fact, it should be emphasized that the research has certain limitations. First of all, this refers to the sample size and the number of tests used to evaluate motor skills.

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